The Electrical Industry's Weekly Magazine

June 5, 1961

Electrical World

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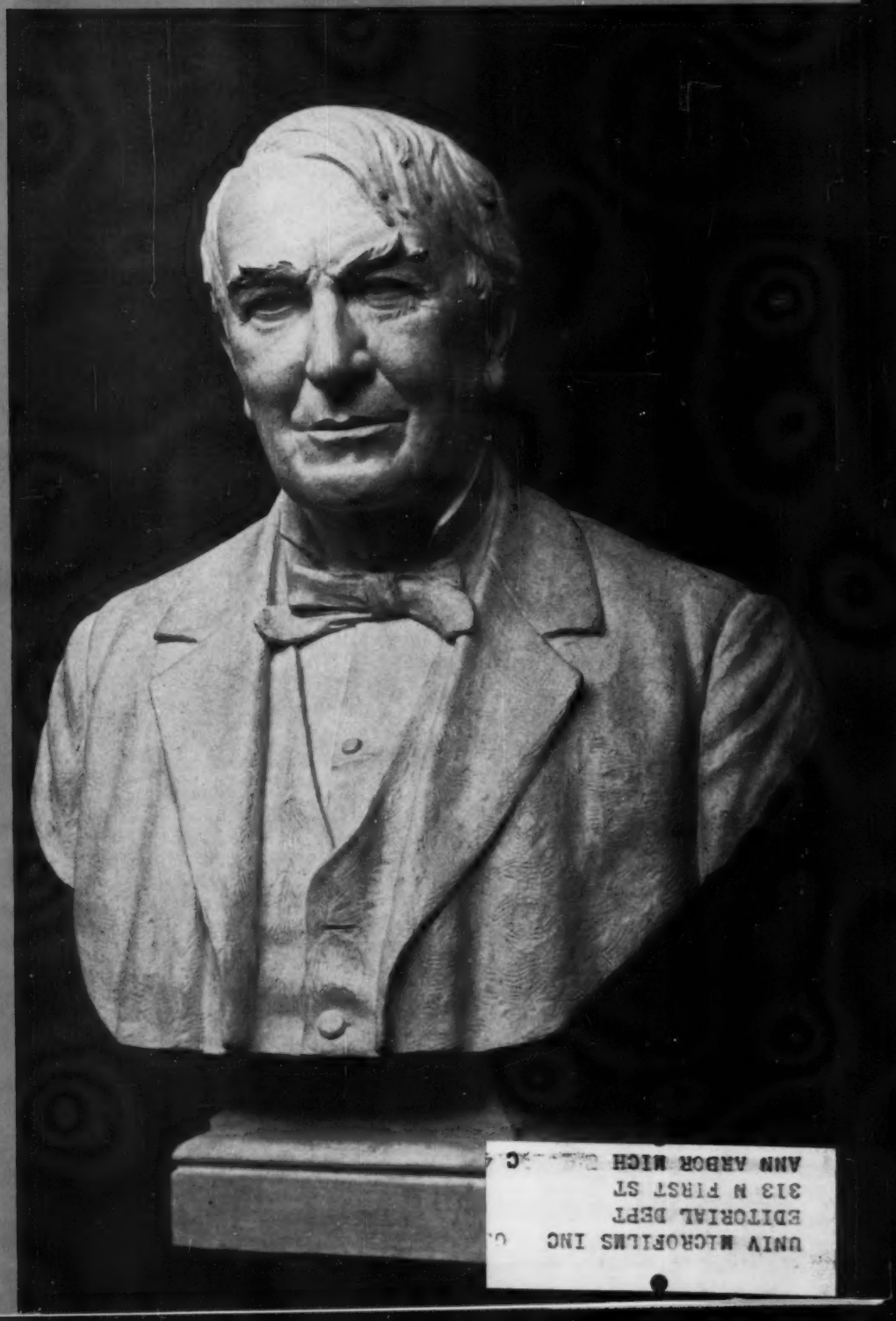

Thomas A. Edison Enters the Hall of Fame

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Electric Heating Survey

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UNIV MICROFILMS INC
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ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-1474

1960 FIRST short-circuit withstand of 40 times Vari-Amp current

1959 FIRST standard electrical drag-hand reset

1958 FIRST with Caliband control

1952 FIRST frictionless voltage-regulation relay

1940 FIRST Vari-Amp feature

1939 FIRST unit construction

1938 FIRST unidirectional breather

1935 FIRST voltage integrating time delay

1933 FIRST 5/8% step regulator

"Firsts" are important—they signify the extensive research, development and leadership at Allis-Chalmers. This program gives you the SFR regulator with its *33% saving in space . . . 30% lower cost per kva . . . 20% less weight.* And continuing research and development provides these additional SFR benefits:

78 fewer bolted connections, faster untanking and testing, all connections in full view—thanks to unit construction.

Fast, accurate control settings—assured by exclusive *Caliband* control.

Oil deterioration reduced—moisture and combustible gases eliminated by the unidirectional breather.

Operation at greater-than-nameplate current when range of regulation is reduced, with *Vari-Amp* position indicator.

Positive series winding protection, by externally mounted regulator by-pass arresters.

These are only a few of a number of benefits you get with Allis-Chalmers SFR feeder voltage regulators. For all the facts — call, wire or write your nearby **Allis-Chalmers** office.

Caliband and Vari-Amp are Allis-Chalmers trademarks.

Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

June 5, 1961
Vol. 155, No. 23

Dateline . . .

Antitrust, Equipment Prices Figure in Rate Case

Houston—Current depressed prices in the electrical equipment market and the antitrust actions against electrical manufacturers are both playing unusual roles in an electric utility rate case now under way here.

While there may be unique factors in the present rate hearing, some of the questions raised are almost certain to kindle nationwide interest.

Principals in the case are: Houston Lighting & Power Co, which is making its first application for a rate increase in 78 years; a special attorney retained by the City of Houston; and the Houston City Council, which acts as the rate-making body.

The utility made its initial presentation in a single day. Since then, the special attorney for the city has been in the process of laboriously cross-examining company witnesses. It is the line of cross-examination that is raising the broad questions.

Adding to the complexity of the case is the fact that the most recent utility rate case adjudicated in Texas upholds a combination of "original cost, less depreciation" and "reproduction cost new, less an adjustment for age and condition" approach to rate-making. Each member of the combination is given equal weight in determining "fair value."

The special attorney for the city has stated for the record that he isn't attempting to cast doubt on company testimony as it applies to the "original cost" element. He accepts those figures as they appear on company books. But he has referred to possible damages resulting from antitrust violations by equipment suppliers. In doing so, he raises the critical question as to whether the company or its customers, or both in part, will be eligible to receive damages in the event such were, in fact, suffered.

The reason for this is that a number of recent decisions have held that increased costs, where passed along to ultimate consumers, do not damage the company passing them along—but rather damage the ultimate consumer. If such were found to be true, it is possible that the company's consumers would have cause of action but the company would have none.

The city attorney has been even more forceful in directing his questioning to the computation of

(*Continued on page 5*)

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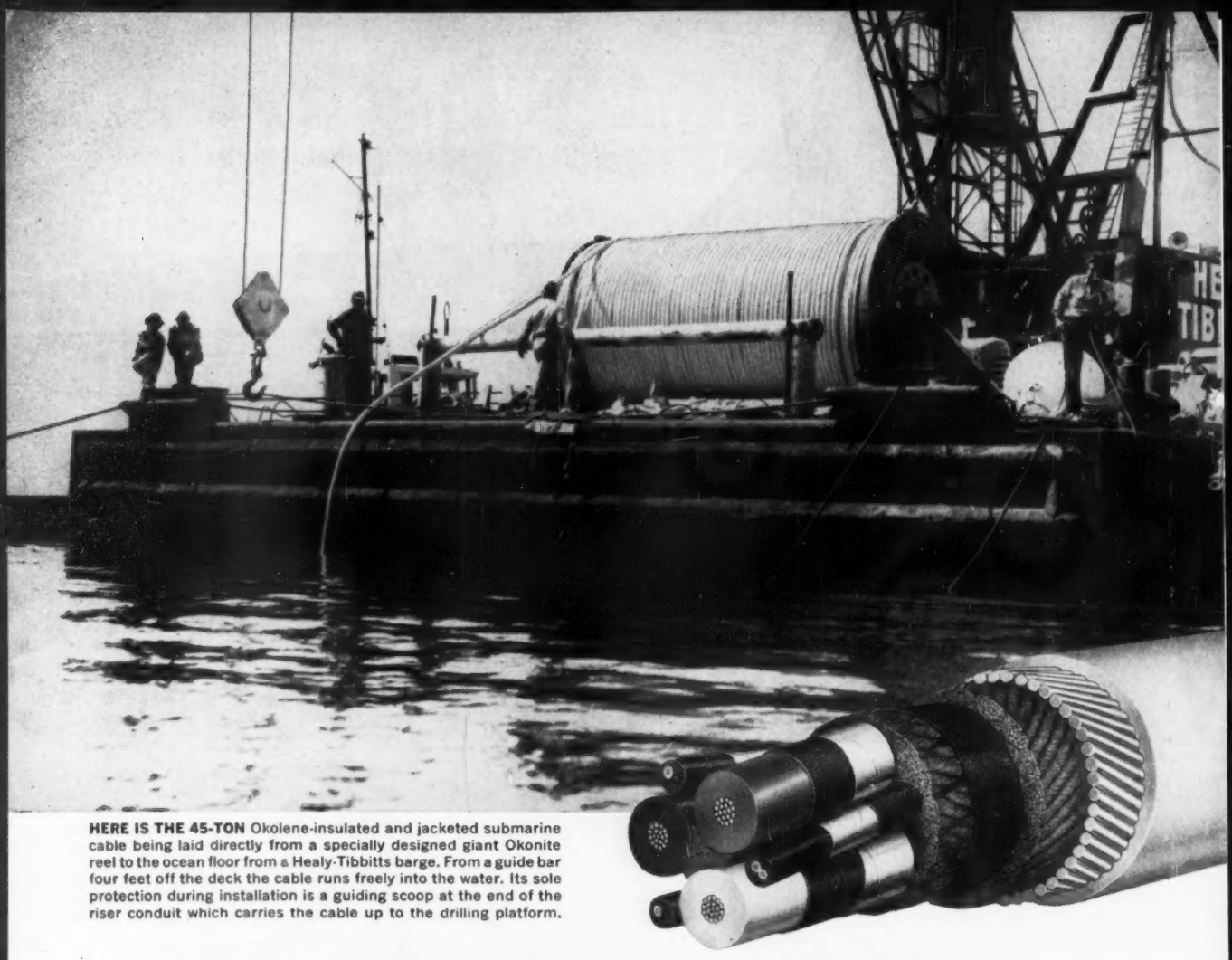

HERE IS THE 45-TON Okolene-insulated and jacketed submarine cable being laid directly from a specially designed giant Okonite reel to the ocean floor from a Healy-Tibbitts barge. From a guide bar four feet off the deck the cable runs freely into the water. Its sole protection during installation is a guiding scoop at the end of the riser conduit which carries the cable up to the drilling platform.

Unique Okonite 17kv polyethylene submarine cable goes to sea

Supplies power and control to a drilling rig located 2½ miles off the California coast.

An Okonite submarine cable—13,700 feet long, more than three inches in diameter, and weighing 45 tons—is carrying power and control circuits from the Southern California coast to a drilling platform 2½ miles off shore. This project is a joint venture of Standard Oil Company of California and Humble Oil and Refining Company.

Handling the historic job is a three conductor 17kv Okolene-insulated cable. This polyethylene insulation was selected because of its high dielectric strength and moisture resistance. Three color-coded, Okolene-insulated pairs are cabled with the power conductors to provide communications, alarm and remote control circuits.

Besides being subjected to all the standard testing procedures, this critical cable went through Okonite's patented Gooding Test Train, which electronically peered through every inch of the cable for flaws not found by normal test methods. This assured the customer the optimum in circuit security.

Standard of California has installed a second cable of this type and similar Okolene submarine cables are now serving other oil companies' off-shore drilling operations, including a number in the Gulf of Mexico.

These installations are just another example of how Okonite Cable'bility* helps solve unusual cable problems. Okonite can handle *your* requirements, too—both large and small—with job-designed cables—cables that assure you of safe, economical electrical power. An Okonite sales-engineer is always ready to be of technical assistance. Call him or write directly to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.

*OKONITE Cable'bility ... cable craftsmanship since 1878.

***where there's electrical power ... there's* OKONITE CABLE**

7351

Dateline . . .

Houston (*Continued from page 3*)

"reproduction cost new." For a fast-growing utility such as Houston L&P, some 70 to 80% of the existing plant was installed in the 1950's when equipment prices were recording new peaks. The company testimony relating to "reproduction cost new" was based on prices prevailing in the 1958-1959 period—the period before the big price-break in electrical equipment.

The special attorney for the city has produced no studies which might indicate the effect of the price-break on electrical equipment as applied to the "reproduction cost" approach to the present case. He has contented himself thus far by questioning the validity of the base period covered in the company testimony.

It is apparent that he is seeking to show that a more recent base period—one that came after the equipment price-break—might give a very different result for arriving at the "reproduction cost new." If he could make this showing, the result would be to cast doubt on the rate base asserted in the utility presentation.

The company contends, however, that "reproduction cost" at December 31, 1960, is within 1% of such cost at December 31, 1958, as a result of the offsetting increases and decreases in various costs of plant. The 1958 date was the one used in original company testimony. Among the offsetting increases, says the company, have been rises in the cost of labor, supplies, and transportation. Other price changes have been noted.

With the hearings being carried on only one or two days each week, there is no indication as to when the case will be concluded.

It has already drawn the attention of several manufacturers because it is among the first to test the effect of the equipment market and the antitrust actions on the rate-making process.

Letters

Not the First, Not the Second

To the Editor:

On page 69 of your April 10 issue under the "South Atlantic" region heading, the last sentence reads: "Delaware P&L's new 66-Mw unit scheduled to go on the line in December of this year will be the first in the nation to burn petroleum coke and oil."

This statement is not correct.

In the first place, the petroleum coke is generally known as "fluid coke," which is more difficult to burn than other petroleum cokes generally known as "delayed coke."

In the second place, Riley Stoker Corp installed three 500,000 lb/hr units burning this coke, oil, and refinery gas in the same plant of Delaware P&L, which went on the line in 1956 and also installed a unit in the Avon, Calif., plant of Tidewater Oil Co in 1958 . . .

R. J. Krieger, Vice President
Riley Stoker Corp
Worcester, Mass.

▶ Previously published stories in our own book belie our assertion that this was the first such unit. We thank you for reminding us.

Story of Sale Greatly Exaggerated

To the Editor:

I would like to say that I am delighted to note from the final paragraph of your article on page 46 of the May 1 issue that we have sold two 15-Mw units to the Philadelphia Electric Co. Unless there is something in the post to us, we are unaware of this. . . .

I would be pleased to know if there is anything we can do at this end to alleviate any possible distress that this mention may have caused. . . .

E. R. H. White
Bristol Siddeley Engines Ltd
Coventry, England

▶ Thank you, but our correction appeared on page 44 in our May 8 issue.

ELECTRICAL WORLD
Vol. 155, No. 23 June 5, 1961

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WHAT'S NEW*

about this Chance 10" EHV INSULATOR?

ALUMINUM CAPS AND STUDS

Save over two pounds in weight A Chance 10 inch insulator with forged aluminum hardware is at least two pounds (usually 2½ lbs.) lighter than any ordinary 10 inch suspension insulator. That adds up to 64-plus pounds saved on a 230 KV, 16 double-string deadend. Consequently Chance aluminum-fitted insulator strings are easier to handle, transport, and install.

Provide better corrosion resistance The forged aluminum alloy hardware effectively resists corrosion. This has been thoroughly proved in use on the highly successful 66160 Chance distribution insulator. The stud is *fully* supported in the body of the insulator . . . corrosion is not intercepted; it is eliminated. The cotter key is stainless steel.

Dissipate heat to reduce porcelain damage Because the aluminum hardware is an excellent conductor, these 10 inch insulators provide the advantage of fast heat dissipation during faults or surges. The porcelain insulator is not subjected to thermal shock damage.

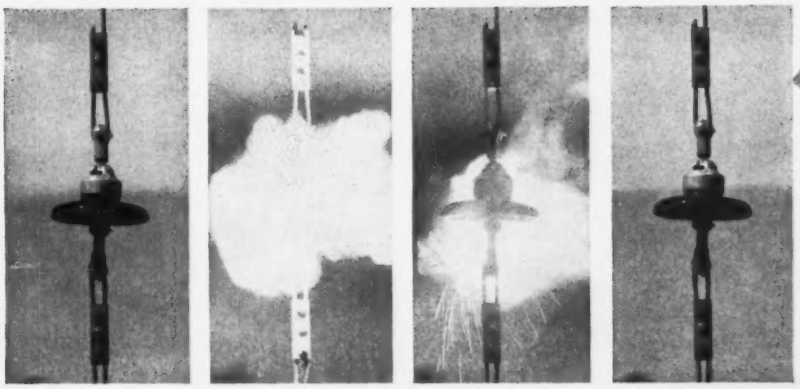
ABC INDUSTRIES

A. B. CHANCE CO.

Centralia, Missouri

A. B. Chance Co. of Canada, Ltd., Toronto

CI61-16

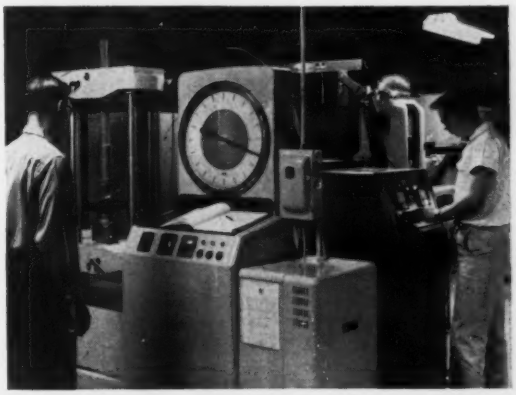


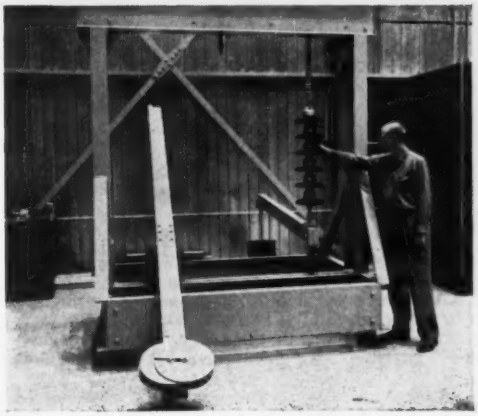
These frames show power arc tests on an insulator under a 4000 pound load subjected to 1700 amps for 10 cycles.

Mechanical and electrical tests after the power arc test prove the insulator free from thermal shock damage. Aluminum dissipates heat faster than ferrous metals to protect the porcelain.

MANY TESTS PROVE THAT CHANCE 10 INCH EHV INSULATORS CAN SERVE YOU BETTER

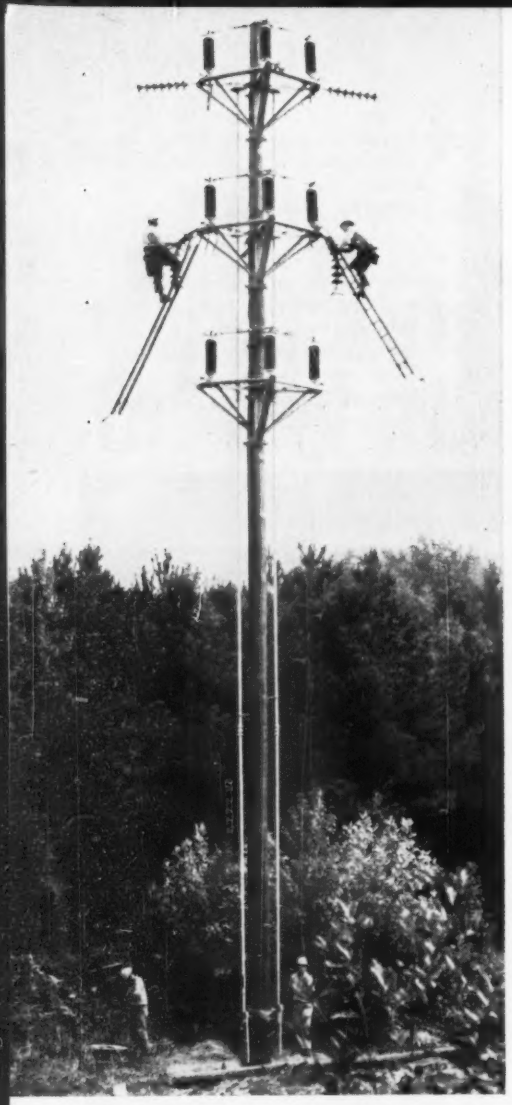
These new aluminum fitted insulators are completely tested to prove their ability to give many years of unfailing service on your lines. Tests include 60 cycle wet and dry flashover tests; positive and negative impulse flashover tests (1½ x 40); steep wave front tests (8000 KV per microsecond rise); high fault current tests; vibration tests; special extended-time load tests; oil puncture, radio noise influence, thermal shock and all standard mechanical and electrical tests. A few of these tests are shown here. For more information, contact your Chance ServiCenter or insulator representative.





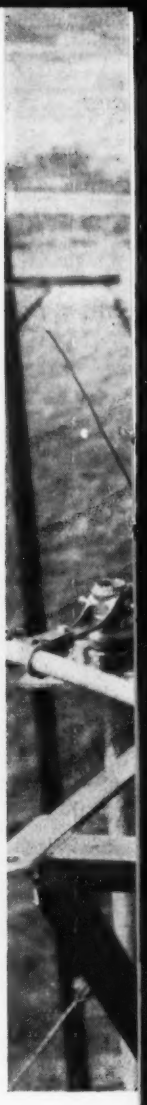
This time load test proves the mechanical strength of the insulators. During the time load tests, the insulators are subjected to daily steep wave front flashover tests to check electrical soundness while on load.

Both aluminum and ferrous metal fitted insulators are subjected to a 500 hour salt fog test. The aluminum insulators show little corrosive effect, while the ferrous caps are badly corroded.



MINIMUM CREW TIME is needed to install Southern States Pole-Pak Air Switches. One pole is all that's needed for three-way switching, compared with conventional arrangements requiring up to six poles. Limited land requirements offer opportunities for installations where other types are not possible. Savings can be substantial.

EXCLUSIVE MOUNTING SYSTEM SPEEDS ERECTION OF SOUTHERN STATES' POLE-PAK



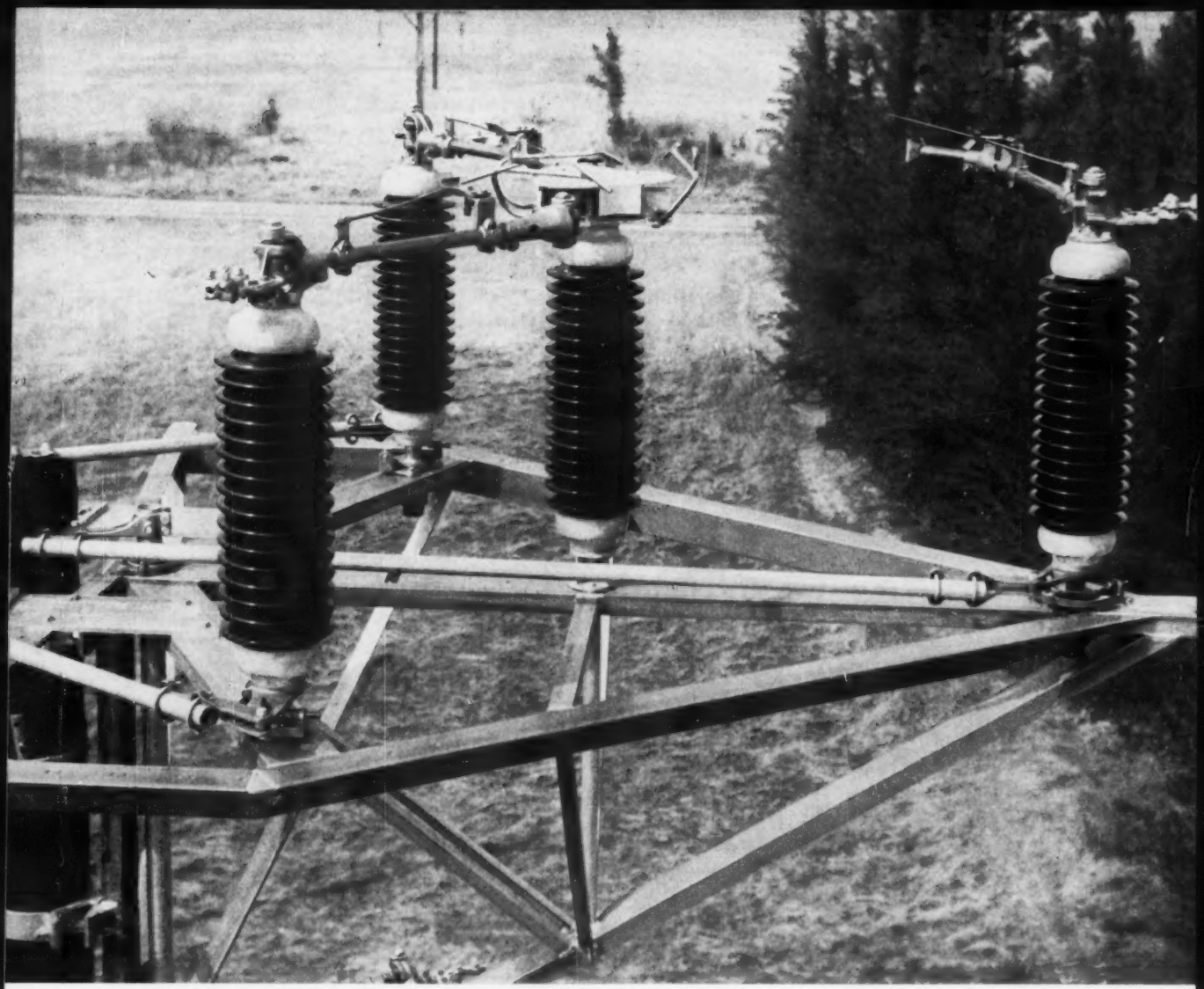
There are many outstanding mechanical and operating features of Southern States Pole-Pak phase-over-phase air switches. But the speed and ease of installation are particularly outstanding advantages.

Southern States employs an exclusive, simplified mounting system. Clamp-type steel bands are fastened to the pole at pre-determined positions. No gaining or drilling is necessary, assuring longer pole life. All switch units are assembled on the ground and hoisted into position. Hooks on the switch frame slip over a mounting plate on the top band, providing temporary suspension and automatically lining up mounting holes for quick and easy permanent bolting. It's that simple!

Other Pole-Pak Features

The Pole-Pak uses Southern States Type 57L braidless air switches. These rugged switches are equipped with Amplitact® contacts, time-proved as the most dependable means devised for handling high short currents.

The Southern States 57L switch is unusually easy to operate. Its blade is designed to toggle into the closed position and has no tendency to open. No force from the operating mechanism is needed to keep the switch closed. The switch is easily oper-



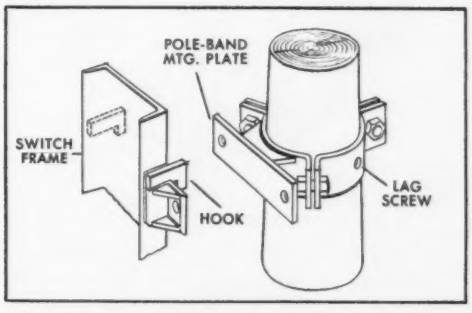
SOUTHERN STATES POLE-PAK is available in voltage ratings from 7.2 kv through 69 kv and continuous current ratings of 600 and 1200 amperes. One- two- or three-way models are available. Southern States Type 57L side-break braidless air switches with Amplitact® contacts are used in the Pole-Pak.

ated by one man, even under icing conditions.

The Pole-Pak frame is constructed of 6061-T6 structural aluminum with adequate bracing for vertical angular pulls in addition to line tensions.

This phase-over-phase method of switching, employing only one pole, with its many time-saving and cost-saving advantages, warrants careful consideration.

Get full information from your Southern States representative, or write for Bulletin 61 PP.



SIMPLIFIED MOUNTING results from exclusive system. Steel band is clamped to pole. Two lag screws prevent slipping. Hooks on switch frame slip over pole-band mounting plate. No drilling or gaining of pole is necessary.

SOUTHERN STATES
HAMPTON, GEORGIA

IN CANADA: DOMINION CUTOUT CO., LTD., TORONTO

new! always RIGHT FOR ANY BI-METAL OR Al TO Al CONNECTION
WEAVER
PARALLEL GROOVE CLAMPS
ni-cad* COATED!
The weatherproof NICAD coating (over a hi-strength aluminum body) keeps any bi-metal connection troublefree, come what may: Heat, cold, salt, alkali, you name it!
They eliminate trouble caused by... (1) Oxidation of Cu against Al; (2) Unequal expansion or contraction of lines and clamps during severe temperature changes. Contacts stay tight—no arcs.
NO SEPARATE INSERTS TO CATCH MOISTURE AND CAUSE CORROSION! NO SOLDERED JOINTS!
Permanent Low-Resistance Connections
WRITE FOR SAMPLES FOR TESTING
Five sizes now available (NI-CAD coated or non-coated) to cover all requirements.
*Extremely heavy coating of cadmium and other corrosion resistant elements
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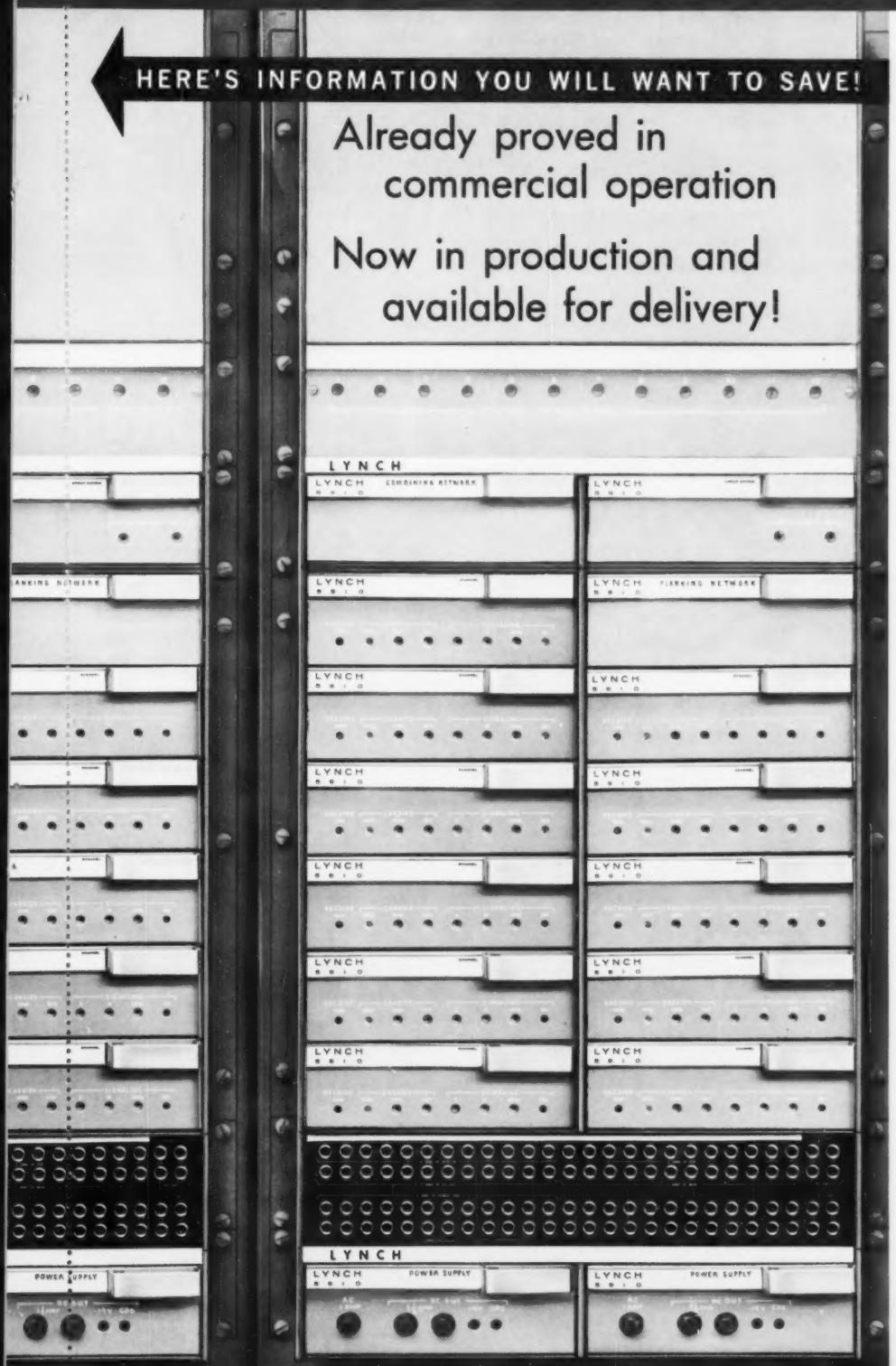
MICROWAVE COMMUNICATIONS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Already proved in commercial operation
Now in production and available for delivery!
LYNCH
POWER SUPPLY

SOLID STATE MULTIPLEXING SYSTEM

Low-cost dependability in today's most versatile microwave communications system!

Economical initial purchase of 1 to 12 channels, easy expansion to 600 channels.

Lower initial, expansion and maintenance costs.

Greater flexibility, with elimination of the need for common equipment.

Filter options for easy drop and reinsert configurations.

New level of reliability . . . up to 120 channels with no equipment common to more than 12 channels, except for the power supply.

All this—and it's available TODAY.

Turn the page for full details

B910 SOLID STATE MULTIPLEXING SYSTEM

Lynch®

LOW-COST DEPENDABILITY

The Lynch B910 is a fully transistorized system offering exceptional operating flexibility and economy for microwave multiplexing applications, and it is also expandable to cable and wire-line operations on a carrier frequency basis to complete a communications system. Spectrum utilization conforms to CCITT recommendations. Lynch also has available an alternate modulation plan to facilitate economical and simple "breakout" of groups of 12 or less voice channels at any repeater or junction station along the line. System arrangements are available which will connect into Western Electric or other carriers of a similar type operating within a corresponding frequency range.

The Lynch B910 system does not penalize the small user . . . it is economically practical for small and large users alike.

The individual channels, occupying a four kilocycle segment, utilize single-sideband suppressed carrier transmission for maximum utilization of the microwave baseband and are individually stackable to the group maximum of 12 channels. Beyond the basic group of 12 channels, the system may be expanded progressively by group modulation methods, to 600 or more channels. It is not necessary to add groups in ascending frequency order, but they may be added at the frequencies required by the microwave system channeling plan according to the individual application.

Each channel of the B910 is completely self-contained in one horizontal drawer, with the exception of the power supply, terminating set and jack field, and includes an individual crystal controlled oscillator for modulation purposes and an individual oscillator for signaling. E & M signaling is standard for all units with all standard telephone signaling arrangements (ringdown, loop, subscriber, etc.) available as optional applique panels. Automatic standby power supply is also available.

An entirely new B910 filter design allows the basic 12 channel system to be translated directly to the 60 to 108 kc spectrum in one modulation step offering a substantial savings in the cost of intermediate group equipment, extra wiring, assembly and testing. In addition, a unique way of deriving the first supergroup (60 to 300 kc) makes it possible to place 120 channels on the microwave baseband without the use of supergroup equipment. No active equipment (except power supply) then affects more than 12 channels.

The Lynch B910 was designed and built specifically for microwave multiplexing application to provide a maximum number of channels on a minimum cost-per-channel basis. Particular emphasis has been given to equipment design with regards to maximum reliability, coordination, operating flexibility and ease of maintenance.

the essential facts . . .

GENERAL

TRANSMISSION . Single-sideband, suppressed carrier.

CHANNELS . . . 1 to 600

CHANNEL SPACING . . . . 4 kcs

SIGNALING . . . E & M or no signaling, standard. All other standard signaling options available with converter panels. Standard 3825 cps on-off signaling. Channel failure indicated by permanent busy signal.

POWER . . . . . Battery or 117 VAC. Approx. 1.2 watts per channel terminal.

OPERATING TEMPERATURES . −20° C to +60° C (−4° F to +140° F)

NOISE (Maximum) . . . . Idle circuit 15 dba, loaded 30 dba.

RADIO BASEBAND CONNECTION

LEVELS . . . . . −30 dbm send and receive (approx.).

IMPEDANCE . . . 75 ohms balanced and unbalanced or other impedances optional.

VOICE FREQUENCY

FREQUENCY RESPONSE . . . . 300 to 3400 cps +1, −3 db.

IMPEDANCE . . . Four-wire, 600 ohms balanced. Two-wire, 600 or 900 ohms balanced with provisions for precision balanced network.

LEVELS . . . . . Four-wire, −16 dbm. in, +7 dbm out. Two-wire, 0 dbm send, receive +1 dbm maximum.

HARMONIC DISTORTION AT TEST TONE LEVEL 2% total maximum at 300 to 3400 cps.

LEVEL STABILITY ±1.5 db with seasonal line-ups.

Lynch

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Electrical World

JUNE 5, 1961
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GEORGIA TOPS ALL STATES in number of commercial electrically heated buildings.

LATE NEWS ▶

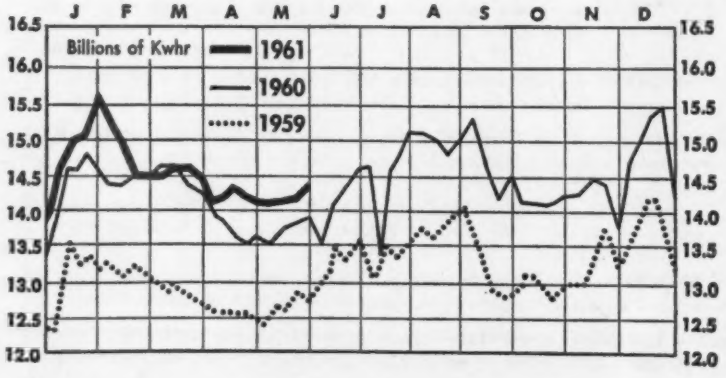
Better competitive situation for nuclear power plants is predicted by General Electric Co in the wake of recent price cuts on enriched and depleted uranium by the AEC. "We have several customers sitting on the edge of their chairs and we hope this will be the last straw to their signing contracts," a company spokesman said. GE estimates the reduction will mean a decrease in the cost of nuclear power of 0.3 mills a kwhr, or about $500,000 a year for single-cycle 300-Mw reactors begun this year. AEC cuts, effective July 1, are on a sliding scale—20% for fully-enriched uranium to 63% for depleted uranium. At the same time, AEC is increasing its fuel-use charge, but this increase is said not to be significant compared to the fuel price decrease.

In another move, AEC says it is considering proposing amendments to the Atomic Energy Act which would allow private ownership of enriched uranium in US. Also under consideration by AEC are other financial incentives to industry, including capital grants to developmental atomic power plants, operating subsidies, fast tax write-offs, and financing of long transmission lines.

Bureau of Reclamation may ask Congress for the opportunity to build the big Bridge Canyon hydro project on the Colorado River in Arizona. The City of Los Angeles and Arizona Power Authority have filed competing license applications with the FPC to build the project, but FPC has given permission to delay proceedings for consideration of joint development. However, Bridge Canyon was originally planned for federal development, and reportedly, the Bureau has never given up its desire to build the up-to-1,500-Mw project.

Nominations of Joseph Swidler and Howard Morgan as FPC commissioners should hit the Senate floor this week with confirmation likely. But four Republican Senators have charged Morgan with lack of candor in testimony before the Senate Commerce Committee. Sens Andrew Schoeppel (Kan.), John Butler (Md.), and Hugh Scott (Pa.) claim Morgan's failure to report two minor arrests in his youth disqualifies him for confirmation. Sen Morris Cotton (N. H.) could excuse this but feels the "lack of fairness and candor" in Morgan's testimony can't be condoned. However, the majority report concludes that his ability to serve was not compromised.

WEEKLY POWER OUTPUT—Up 3.2% (Week ending May 27), Kwhr 14,390,000,000



Percent Change From Previous Year

	May 13	May 20	May 27
Total U. S.	+ 4.1	+ 3.8	+ 3.2
New Eng.	+ 6.4	+ 6.7	+ 6.6
Mid. Atlan.	+ 4.9	+ 4.4	+ 3.8
Cent. Indust.	− 0.7	+ 1.2	+ 1.9
West Cent.	+ 5.2	+ 5.4	+ 2.2
Southeast	+ 2.4	+ 2.7	+ 2.8
South Cent.	+12.8	+ 8.5	+ 4.8
Rocky Mount.	+10.5	+ 7.7	+ 9.3
NW	+ 7.0	− 1.9	− 3.7
SW	+ 6.9	+ 8.1	+ 8.0

Seasonally Adjusted Index 284

Week Ago 290 Year Ago 275

Source: Edison Electric Institute

Supply Lines

EEI PURCHASING MEN DEBATE PERFORMANCE MEASUREMENT

Measurement of utility purchasing performance sparked keen interest among members of the Edison Electric Institute Purchasing and Stores Committee meeting in Houston last month, with almost as many approaches to the subject as there were members present. The 130 Committee members present also exchanged experiences on new purchasing practices including one called "automatic purchasing." Discussion on the stores segment of the meeting was reported in this space last week.

Question was raised as to whether purchasing agents were attempting to evaluate the efficiency of their own operations or whether they were trying to evaluate their departments' contribution to trimming over-all company expense. The answer seemed to be "both," but means of measurement varied widely. D. J. Fitzgerald, Baltimore Gas & Electric Co, stressed the measurement of individual performance, but said his department also tried to keep top management informed on unusual savings resulting from purchasing. Monthly reports on the number of orders placed and the number of salesmen interviewed are also reported to management. A continuing appraisal is made of individual purchasing personnel, and each is informed of this appraisal. Such appraisal is made by the department manager based on his first-hand observation and on standards set by him.

A more unusual approach has been taken by Alabama Power Co's purchasing department, where an attempt has been made to estimate potential savings in total purchasing budget that may accrue from efficient practices. George Cole, reporting on this approach, argued that savings totalling nearly 8% might be reached as a result of efficient purchasing department operation. Among the activities which might contribute to such savings, he listed: a trained organization of specialists, streamlined paper work, better interdepartmental coordination, effective inventory control, contributions to company public relations, alertness in inspection and testing, and rapid claim handling. But Cole warned that attempts to trim the operating budget of a purchasing department might be false economy. The main aim, he said, should be to increase the effectiveness of the department so that savings in materials, products, and equipment can be realized.

Efforts to reduce paperwork in the purchasing function received passing attention, with one participant suggesting that purchasing orders, requisitions, and such might figure out at $1 per line of text.

Quantitative approach to reviewing purchasing practices was presented by R. H. McNeal, Cleveland Electric Illuminating Co, who headed an EEI committee task force which surveyed practices of some 33 electric utilities. Not all companies answered all questions. Here are some of the significant results:

- More than 66% of the companies responding reported they do periodically analyze purchasing performance by some means.
- Nearly the same percentage say this appraisal is reported to superiors.
- Of those making analysis, approximately 30% do this on a monthly basis, 58% on a quarterly basis, and 12% on an irregular basis.
- But only 25% have established standards which would enable them to analyze thoroughly the operational activity of purchasing.

Utilities use a number of standards of measurement with the most popular being quantity and cost. Some attempt to measure quality and planning, McNeal reported.

In the measurement of quantity of work, results of the survey revealed the most

McNEAL

measured items to be the number of business interviews held and the amount of sale of material—40% noted these items. Next in line were the number of items purchased, number of open orders, and number of formal requests for bid. Other methods of measuring quantity included items purchased per buying man-hour, number of orders issued, number of change orders issued, number of requisitions received, the percentage of total purchases less than $100.

In the area of cost and expense, 55% of the utilities responding to the questionnaire mentioned measurement of labor dollars. To a lesser degree, the replies showed measurements being made for other-than-labor expenses of purchasing and of trends of prices paid both in general and for selected items of purchase. **Standards have** been established by five companies for trends of prices paid on selected items.

Quality of a purchasing operation is more difficult to measure, McNeal asserted. Among the items in this category are vendor relations, but this is being measured by only 31% of the companies. Other items in this area—on-time deliveries, open orders overdue, availability of written procedures, and rejected material—are receiving attention from 20% to 25% of the companies responding to the committee survey.

One of the toughest items to measure is relations with other departments. Only means of analyzing such performance suggested by the survey results was to check with other departmental managers and to note various instances of cooperation.

Purchasing reports to management take a variety of forms. Among the statistical data furnished management are figures on material commitments, bid analyses of large purchases, special market trends, budget reports, and salvage sales reports.

In a brief look at purchasing practices, McNeal's task force threw some interesting light on current ordering procedures. A survey of utilities represented on the EEI committee disclosed that the average requisition for stock material covers requirements for three months or less. This is true for 94% of those responding. A breakdown of the count shows 25% covering one month's requirements, 25% two months' requirements, and 44%, three months' requirements. In over 60% of the cases the requisition calls for a single shipment.

MAGNESEN

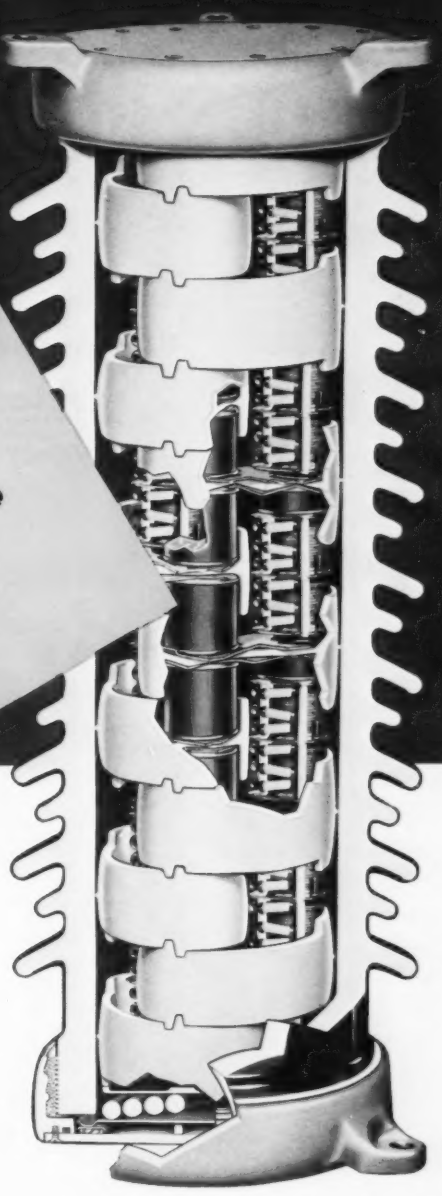
A method of "automatic purchasing" worked out by Commonwealth Edison Co was described in a paper by C. J. Magnesen. He called the procedure "a simple one which utilizes mechanical equipment to review stock balances and automatically prepare requisitions which show the description, quantity to be ordered, receiving location, past use, and other related data." Magnesen said the procedure also provides central purchasing control which reduces errors and expedites the issuance of purchase orders.

Among the specific advantages of the system, Magnesen reported, are: reduction of clerical work at stocking locations by eliminating typing of requisitions and some filing, easy method for disclosure and elimination of obsolete items, and the flagging of items of dubious future for human review.

As of a year ago, there were 5,206 items stocked under this machine review. Some of the kinks have been worked out of the procedure and studies are now underway which would greatly expand the number of items covered.

Tops in station protection

Better arrester valve block use establishes easier passage of lightning surges



Thorex Dynagap Station Class lightning arresters offer top grade protection for major station equipment. As evidence, check O-B catalog 37 for maximum IR discharge voltages -- the common industry measure of a lightning arrester's protective ability. These values are the lowest available from any station arrester.

Conventionally, valve blocks of silicon carbide provide most of the resistance to the 60-cycle follow current, but not in O-B's Thorex Dynagap arrester. More than 90 per cent of this resistance is produced by the Dynagap (O-B's current limiting gap).

Because of the lighter duty imposed on them, Thorex valve blocks are designed to offer less resistance to lightning surges and transients, permitting lower IR discharge voltages. This design is so successful that O-B is able to publish the lowest IR available . . . and the values are *absolute* maximums, too.

What does this mean for your station equipment? You can have protective margins that were unheard of only a few years ago . . . lower BIL ratings . . . and better protection for older equipment of questionable insulation strength.

Only Thorex Dynagap lightning arresters can give you this top protection. You can have it in your stations . . . at no premium in price.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

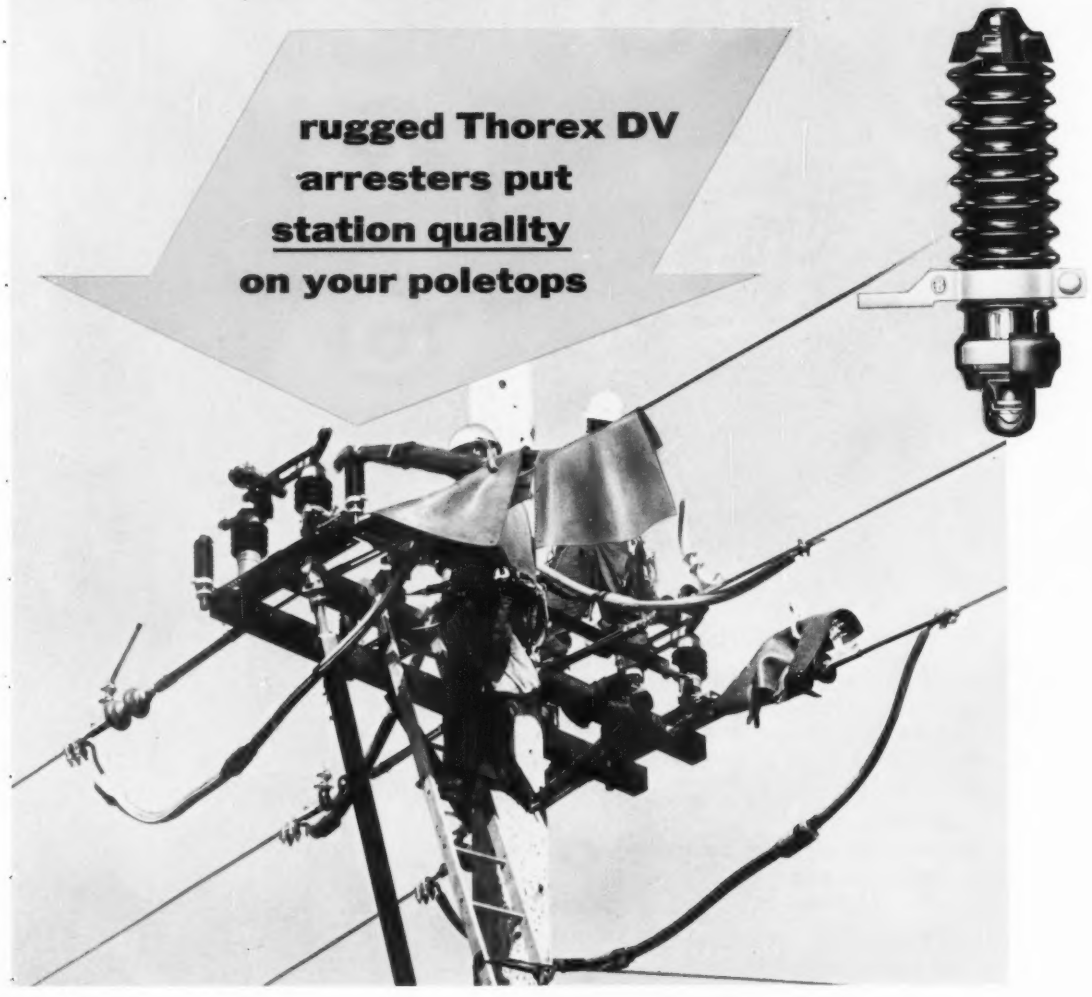
HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10110-H

for tops in distribution protection
SEE NEXT PAGE

Tops in distribution protection



Thorex Distribution Class lightning arresters bring essentials of station class performance to distribution systems. Used interchangeably in every class of Thorex lightning arresters, the Dynagap imparts dramatic benefits: (1) IR discharge voltage that is only slightly above some Station Class designs and (2) durability that is nearly 3 times better than ASA standard low-current, long-duration requirements for Station Class!

As in the Thorex Station Class arrester, Dynagap assumes much of the job of power-follow current limitation formerly handled by the valve block. Now free of this burden, the valve block has incorporated lower IR characteristics for better equipment protection and greater ability to withstand heavy surge discharges of long duration.

Thorex Dynagap DV arresters are tops in the degree of service and equipment protection they afford . . . and you can get this premium performance on your poletops just by specifying O-B Thorex Dynagap.

Four different models fit every line location: transformer mounted, line terminal connected with ground isolator, line lead connected with ground isolator, and line terminal connected with external air gap.

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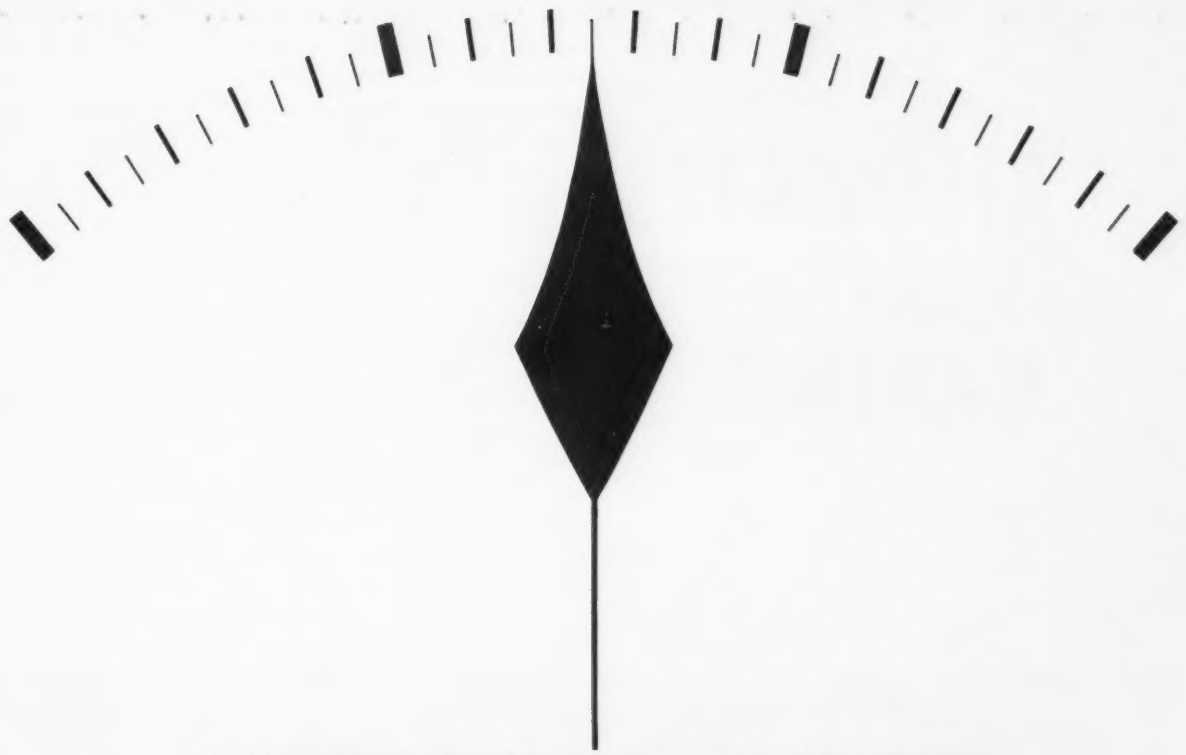

New Westinghouse Economy Switchboard Instruments —accuracy permanently assured by Taut Band Suspension

This new K-221 Westinghouse 4½" rectangular 100° scale design offers the greatest economy of any high quality switchboard instrument available on the market today!

Yet these a-c and d-c instruments give you the superior performance of Westinghouse Taut Band Suspension. No friction; almost infallible repeatability; higher sensitivity, less upkeep, and greater durability than pivot-jewel bearing types. And Westinghouse *tbs** instruments will withstand extreme vibration and shock that would play havoc with ordinary designs.

For top performance at low cost, specify K-221 switchboard instruments. The 221 is an extension of the Westinghouse standard instrument line, and like all Westinghouse instruments, meets or exceeds the requirements of ASA standard C-39.1.

For complete details on K-221 switchboard instruments and for a sample of Taut Band Suspension, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse.

*Trademark of Westinghouse Taut Band Suspension instruments

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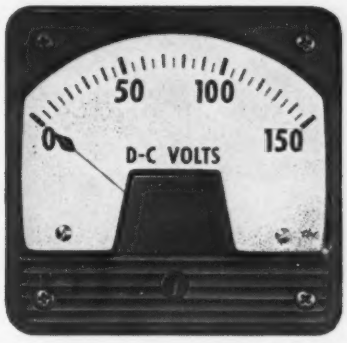
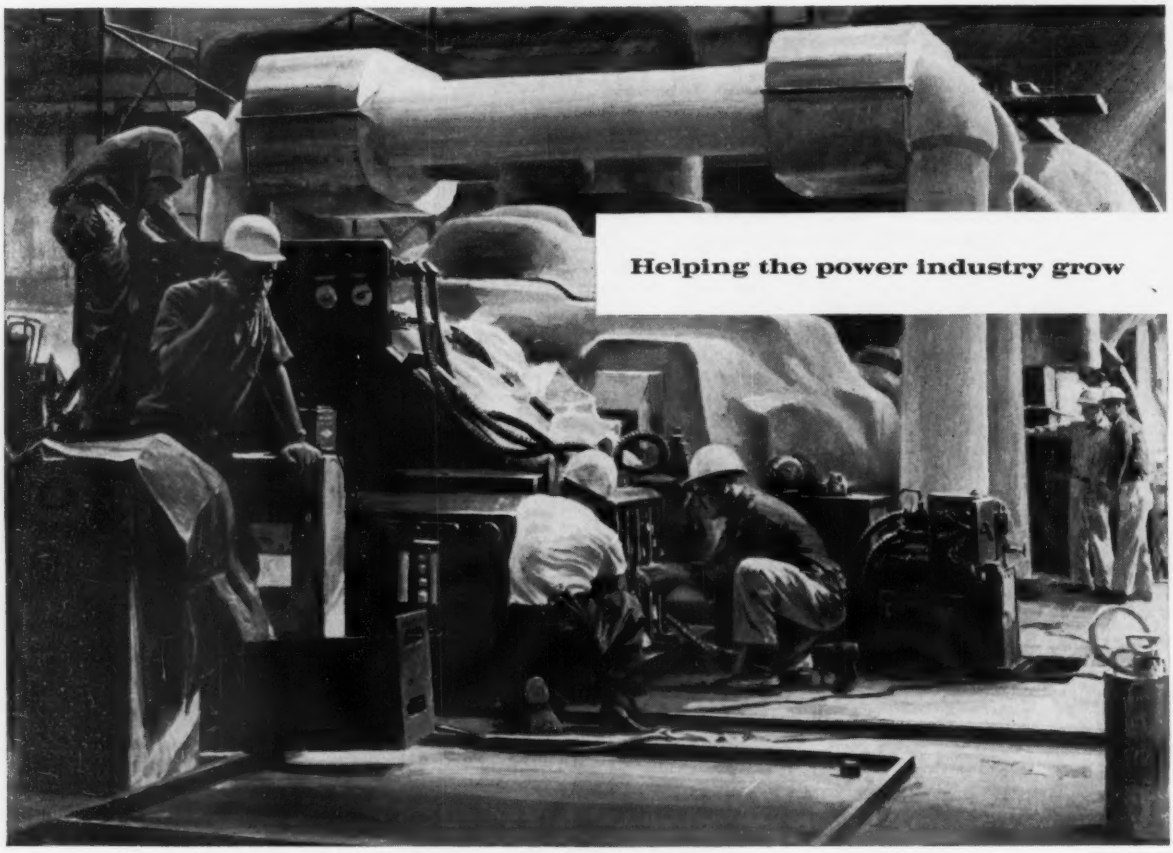


Westinghouse

KILOWATTS IN THE MAKING

Checking circuits against blueprints, making final connections and testing switches, electrical workers ready a giant turbogenerator for its initial run. In plants like this United Engineers men are at home. This is the natural result of years of experience working on power projects—big and small, from coast to coast. Our power specialists have designed and constructed hydroelectric and thermal plants, electric substations, and plants for supplying heating and process steam. Whatever the project —power, process or gas plant, steel mill or industrial building—from our wealth of trained personnel we can assemble a crack team to handle it. The men who are United Engineers offer you a background of over 75 years' experience as designers, construction engineers, and engineering consultants.

Painting by Robert Lavin



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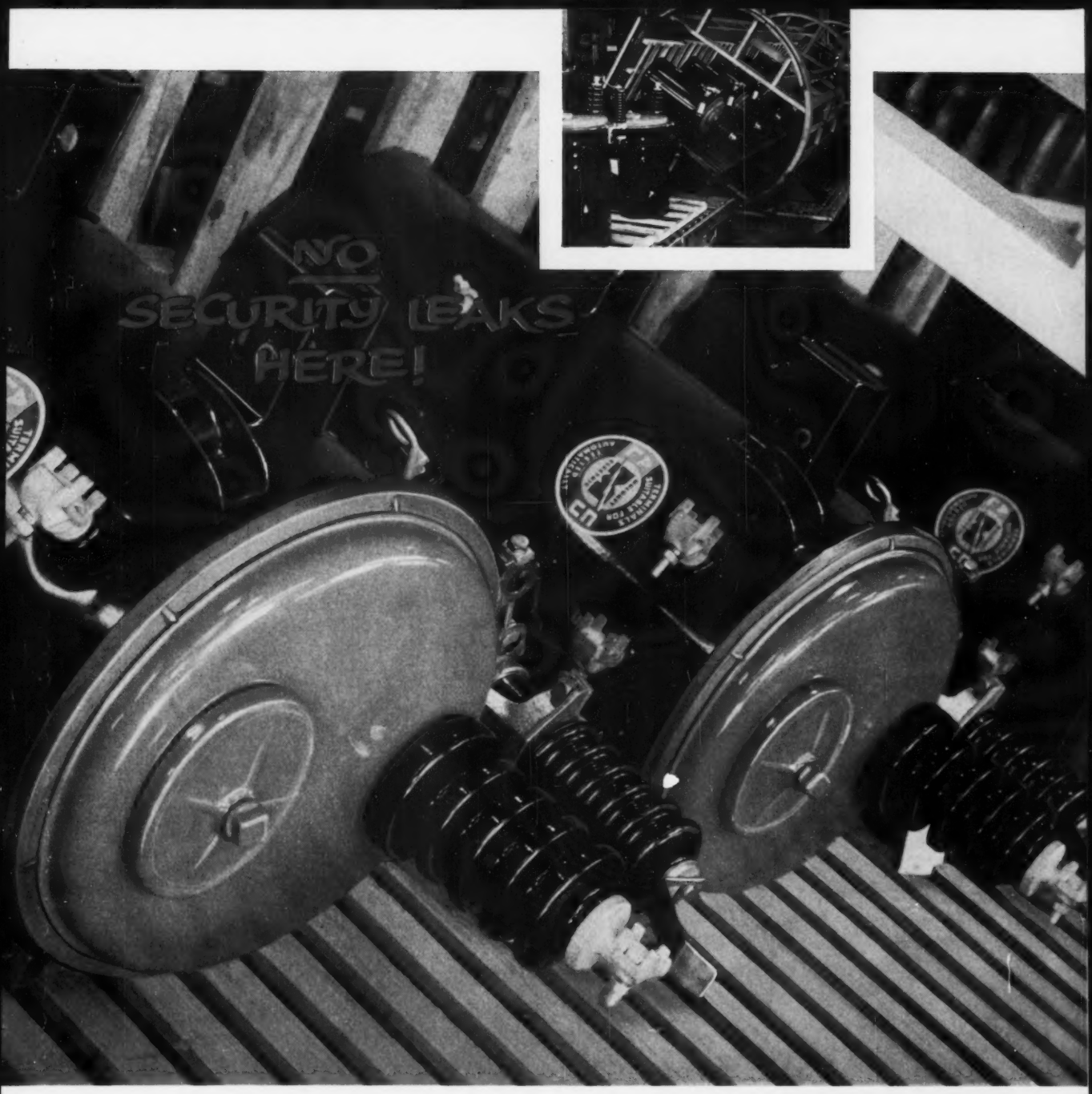

In the interest of security we literally turn things upside down looking for leaks.

Yes, Moloney Distribution Transformers are actually turned upside down during our Inversion Test. They must pass this security test which detects any leaks due to faulty seal.

When you purchase Moloney Distribution Transformers, you can feel secure from outages and frequent maintenance problems caused by moisture and sludging . . . two very subversive elements.

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What happens when you don't buy the best machine for the job... simply because it's made outside the United States?

Your company loses the savings or superior performance the machine would deliver.

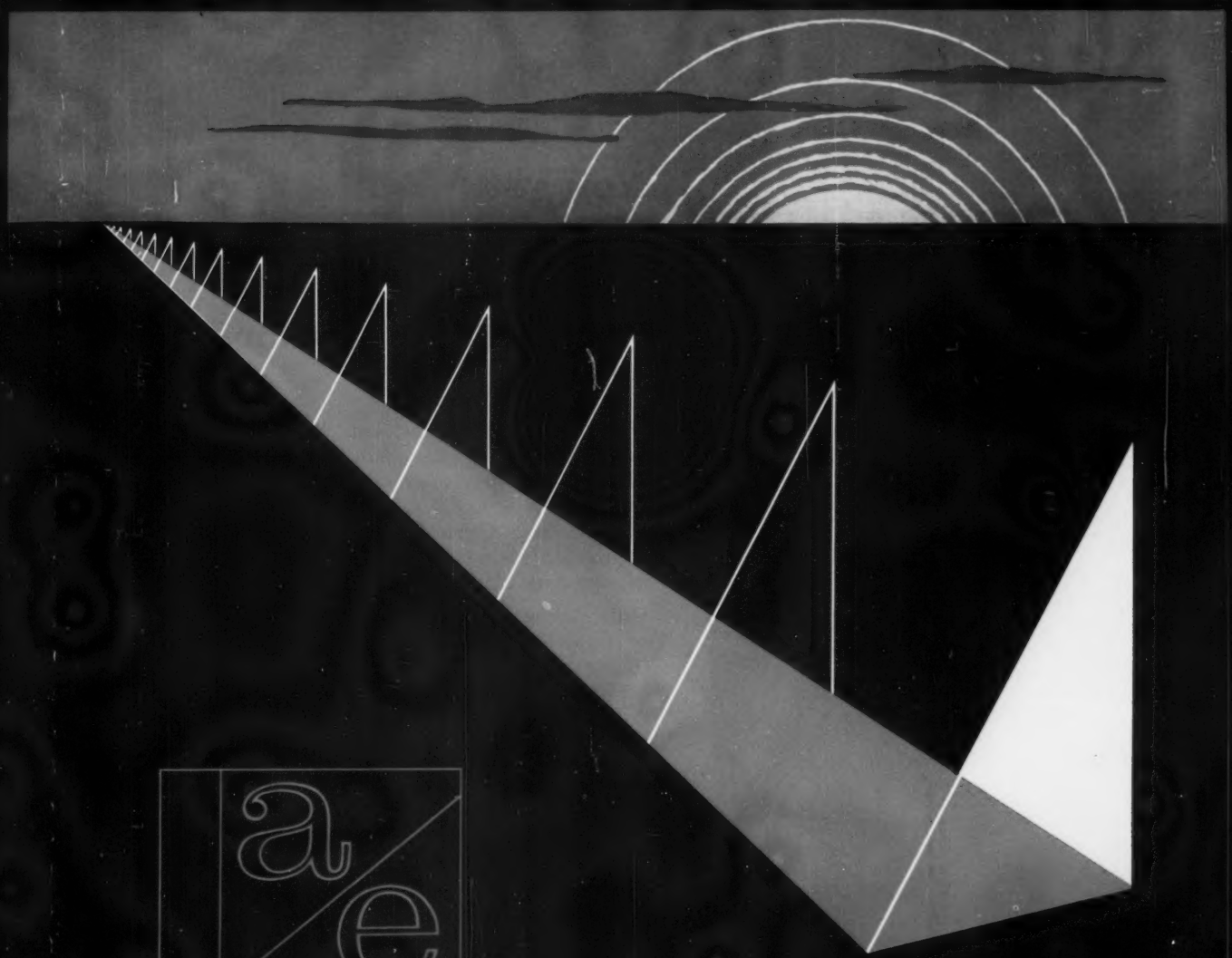
You discourage the foreign trade that last year netted the U. S. a healthy $5 billion trade surplus.

You encourage the idea that U. S. manufacturers should rely on protection instead of competition.

None of these are good for you or for the United States.

BROWN BOVERI

Equipment for generating, transmitting and utilizing electric power.
Send for free booklet explaining the advantages of foreign trade.
Brown Boveri Corp., Dept. EW6,19 Rector Street, New York 6, N. Y.

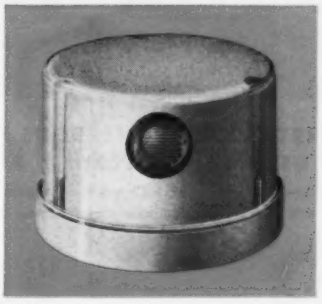


AMERICAN ELECTRIC

STREET LIGHTING CONTROLS

Improved RCA cell, same reliable circuitry, smaller size

Here's the first photoelectric street lighting control to use RCA's improved cadmium cell. The light sensing element is glass enclosed like a vacuum tube to insure a positive hermetic seal. Failure from atmospheric leaks is practically eliminated. *Not new,* however, in American Electric's 8000-1 Control is a special arrestor which protects components from repeated surges. (We introduced an arrestor on our first cadmium cell control three years ago . . . now all manufacturers' controls are similarly equipped.) This combination of features, utilizing the same proven reliable circuitry, assures you of greater dependability than ever before in automatic street lighting control. For appearance, Model 8000-1 has a modern low silhouette and molded acrylic cover; for convenience one unit fits both old and new style luminaire heads. Test this better control on your street lighting system. Phone or write today.



American Electric Manufacturing Corp., 3271 Chelsea, Memphis 8, Tenn., *Representatives throughout the U. S.*

FERROUS OR NON-FERROUS FITTINGS CAN BE USED WITH COPPERWELD ANCHOR RODS.

The threaded ends of each Copperweld Anchor Rod are heavily coated with pure tin to permit the use of ferrous or non-ferrous fittings.

You get lasting security with Copperweld Anchor Rods

Because an anchor rod is used in the ground where its entire length cannot be seen, its holding power is often taken for granted. Yet, anchor rods are vulnerable—primarily at or just below the ground line. Here, the rods are subject to rusting and loss of strength due to the action of corrosive soils, moisture and air carried down by surface waters.

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Copperweld Anchor Rods are available in various lengths and diameters. For complete information on these non-rusting anchor rods, write for Engineering Bulletin E. D. 1883.

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Solve peak-load and standby problems! F-M's exclusive O-P Diesel Generating Units provide *full* power in 15 short seconds . . . *from a cold start!* They need no spinning reserve. Use no power till you use them! The reason? Our exclusive O-P (Opposed-Piston) design. Two pistons in one cylinder function from a *single* combustion. This minimizes *vibration* . . . produces fine *balance, smooth* power to peak the generator—in just 15 seconds! F-M Opposed-Piston Diesel Generating Units are available with automatic or manual controls. Produce up to 2500 kw per unit. They may be linked in multiple units for peaking, standby duty . . . or dead load pickup! You can't buy better—or more economically.

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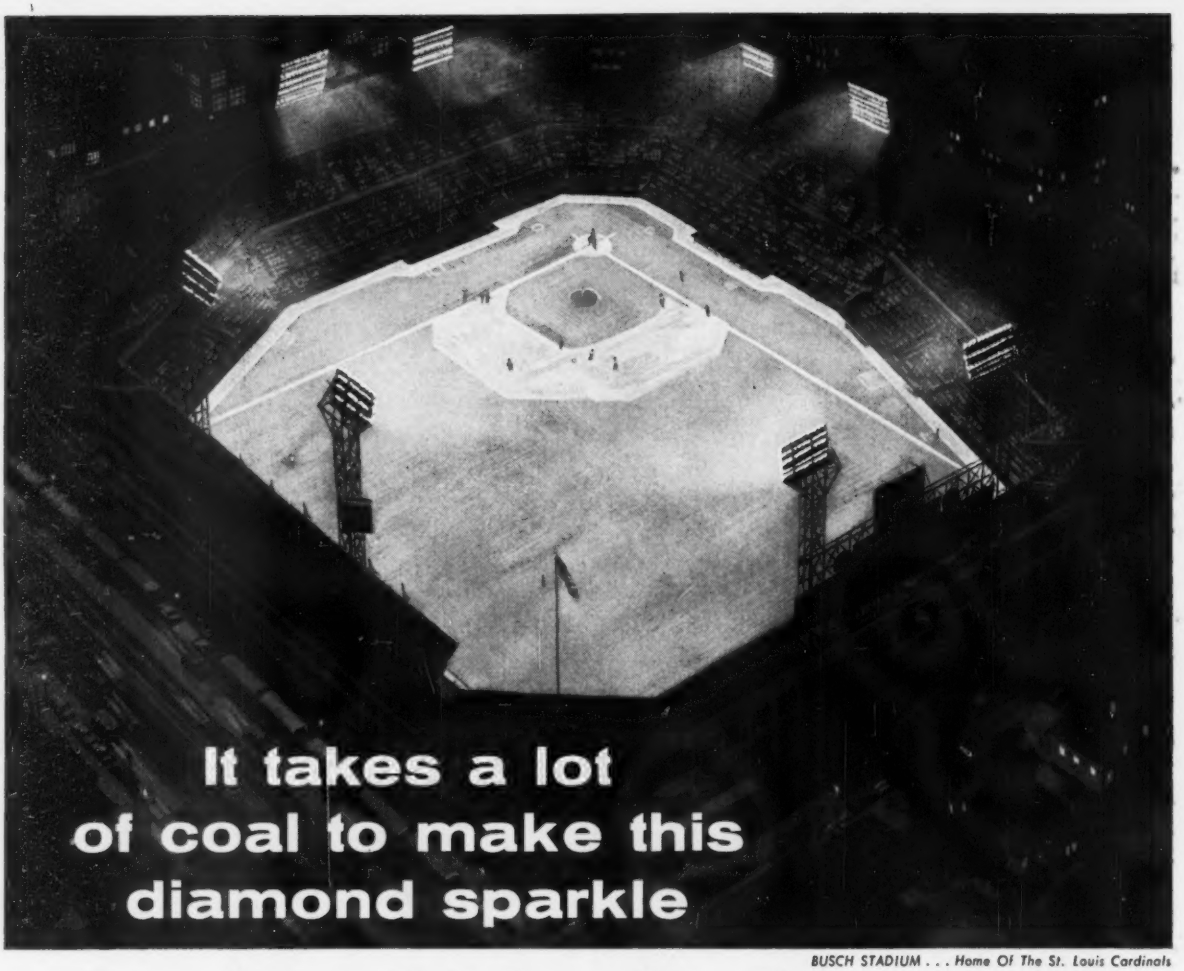

BUSCH STADIUM . . . Home Of The St. Louis Cardinals

For an Average Night Game, Union Electric of St. Louis Uses About 6,000 Pounds of Coal to Generate the Electricity That Lights Busch Stadium

The electricity that lights Busch Stadium is generated principally by coal, and Peabody is one of Union Electric's major suppliers. In our homes, offices, plants . . . even at the baseball games . . . coal serves us by generating dependable, economical power. In fact, one of the primary reasons for the continued low cost of electricity is the stabilization of coal prices—a direct result of big, fully mechanized mines such as those operated by Peabody. Not so strange then, that coal generates more electricity than all other fuels and water power combined.

Peabody Coal Company . . . with over two billion tons of proven reserves . . . supplies coal to many of the nation's leading Electric Utilities that furnish you this power . . . at a price you can afford to pay. The next time you watch a night baseball game . . . at the ball park or on your television set . . . think of *coal* and the great Electric Utilities that help make it possible.

If you are seeking a new plant site, Peabody can be of assistance to you. Contact us for information on strategic industrial locations. No obligation, of course! Call today or write Department EW.

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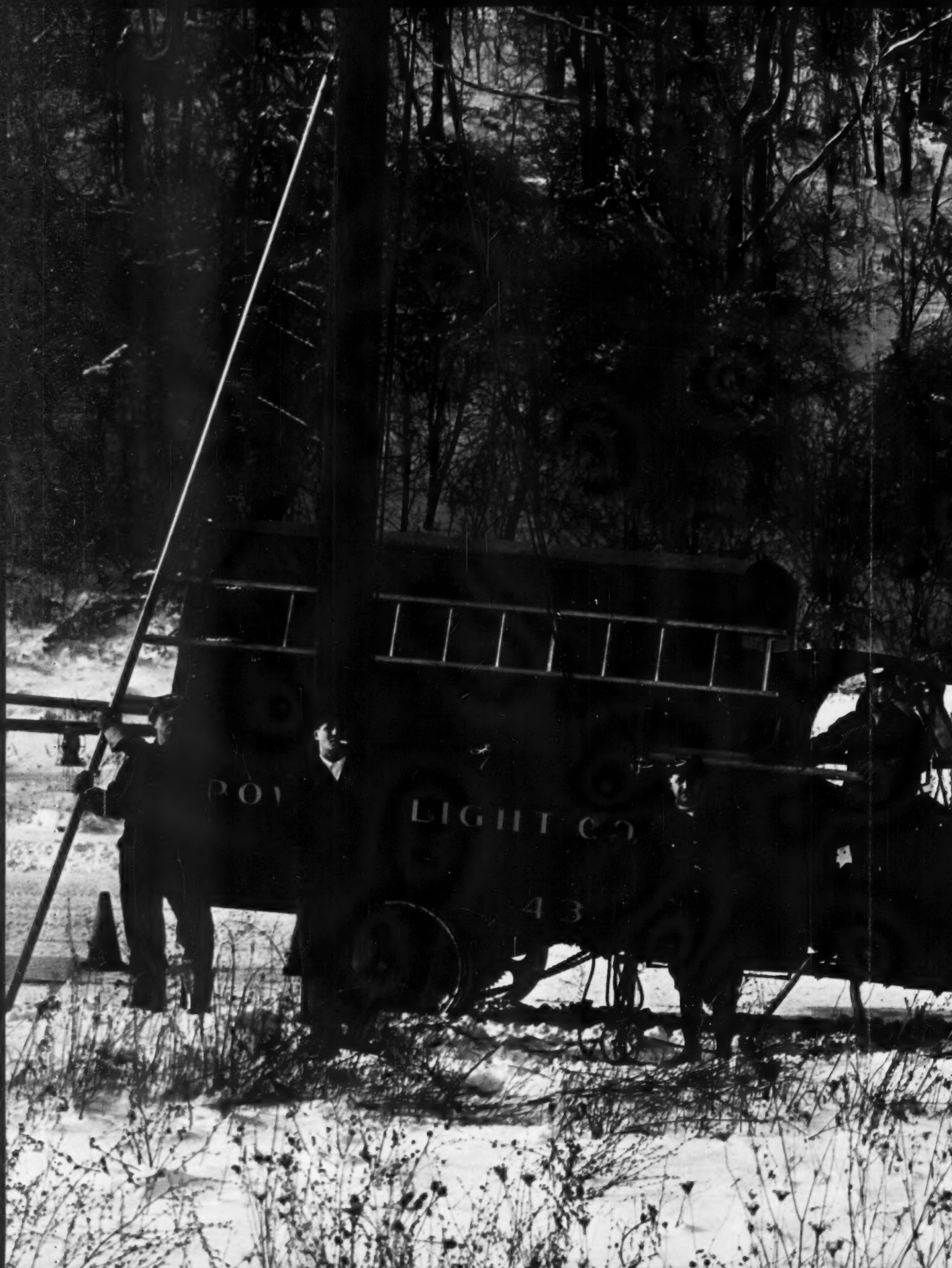
Is your distribution voltage regulation

Obsolete?


LIGHT CO
43

uno -reg

Is your method of regulation for distribution voltage as old fashioned as the chain driven line truck? Or does it include the Westinghouse UNOREG — a new idea in voltage regulation. UNOREG permits "head-end bucking"... a wholly new concept for regulating distribution feeders. It is as dramatically different from old forms of re-regulation as the contemporary line truck is from its 1923 forebear. It can save you thousands of dollars annually in regulating costs. How? Through modern thinking, planning and design, UNOREG can reduce your costly voltage regulator inventory, step up total system performance, and reduce your initial capital investment in regulation equipment by as much as 50%. There are huge savings in installation, in reduction of customer complaints, in service and application.

UNOREG is truly the most modern form of voltage regulation available today. Install it and forget it. When this small (21½" high, 12¼" diameter) unit goes up, you have a modern distribution regulator. The UNOREG regulates on the secondary and is independent of primary voltage. It reduces inventory (just two models, the 1¼ and 2½ kva, cover over 630 standard styles of distribution transformers). It represents a wholly new concept of voltage regulation that can solve any distribution system voltage problem. Compare UNOREG with any regulating device. You'll find it provides the very best, most economical re-regulation available. Contact Westinghouse for more information on the UNOREG—today's and tomorrow's answer to economical distribution.

You can be sure... if it's Westinghouse.

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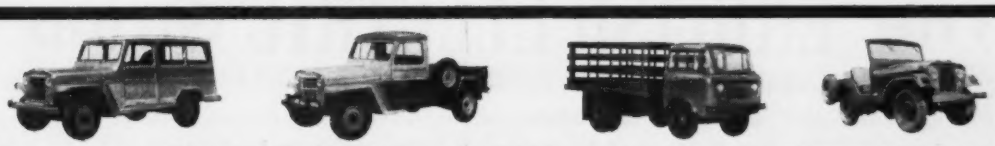
JI-70959

known by the companies it keeps moving

Thousands of leading American companies keep their investment at a minimum with a 'Jeep' fleet. Great versatility and low initial cost give you the most versatile vehicle you can possibly get for your money! Traditionally rugged 'Jeep' construction keeps maintenance costs low and the resale value high. Get in touch with us today for complete 'Jeep' VEHICLES information! **Write to: Robert J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.**



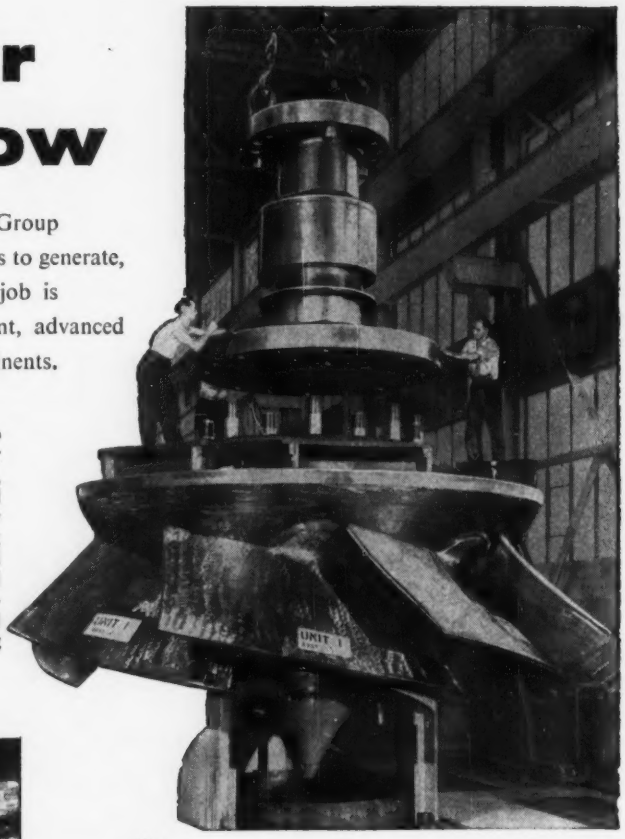
'JEEP' FLEETS—FROM THE WORLD'S LARGEST LINE OF 4-WHEEL DRIVE VEHICLES

Willys Motors, Inc., Toledo 1, Ohio. One of the growing Kaiser Industries.

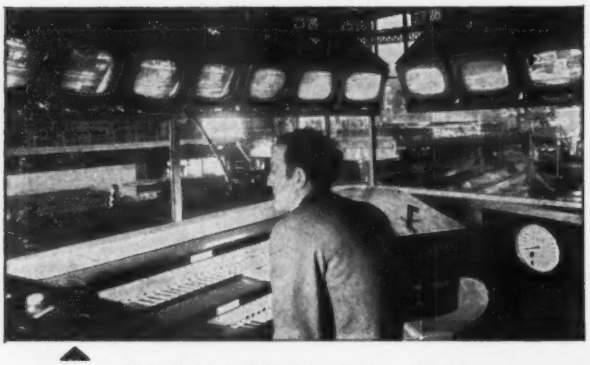
More power to your elbow

Wherever power is needed the 'ENGLISH ELECTRIC' Group is there creating new and more efficient means to generate, distribute and use it. Every 'ENGLISH ELECTRIC' job is backed by world-wide technical achievement, advanced research and manufacturing experience in five continents.

Amongst the activities of the 'ENGLISH ELECTRIC' Group are the design and manufacture of: equipment for complete electricity supply systems employing steam, oil, water, gas, or atomic power for generation; electric and diesel-electric locomotives and equipment for railway electrification; marine propulsion and auxiliary plant; aero engines, aeronautical research and testing plant, and aircraft equipment; all classes of industrial electrical equipment and complete electrifications; domestic electrical appliances; industrial electronic, radio, radar, and television apparatus, and electronic data processing equipment; meters, relays and instruments.



The Sir Adam Beck-Niagara Pumping-Generating Station in Canada incorporates six 'ENGLISH ELECTRIC' Deriaz variable pitch reversible pump/turbines. Each is rated at 45,500 h.p. as a turbine under 83 ft. head, and will discharge as a pump 4,000 to 5,000 cubic feet per second under heads from 59 to 90 ft. The pump/turbines, of a new basic design developed by 'ENGLISH ELECTRIC' in England, were supplied to the Hydro-Electric Power Commission of Ontario by English Electric Canada, a division of John Inglis Co. Ltd., and manufactured at Toronto. This illustration shows a runner hub assembly at the John Inglis plant.



On the 45-in. Universal Slabbing Mill at the Abbey Works of The Steel Company of Wales, the ingots are transferred from soaking pits to the mill by means of electrically driven rail cars. The drives and remote control scheme were engineered and supplied by 'ENGLISH ELECTRIC'. With the aid of fifteen television cameras and monitors in a closed circuit system, designed and installed by Marconi's Wireless Telegraph Co. Ltd., the operator is able to follow every stage of the operation and to control the vehicles with speed and accuracy.

The 'ENGLISH ELECTRIC' Deltic locomotive, powered by two 1,650 h.p. Napier Deltic diesel engines is the most powerful single-unit diesel-electric locomotive in the world. Twenty-two of these 3,300 h.p. locomotives are being built by Vulcan Foundry for British Railways.

The 'ENGLISH ELECTRIC' Group

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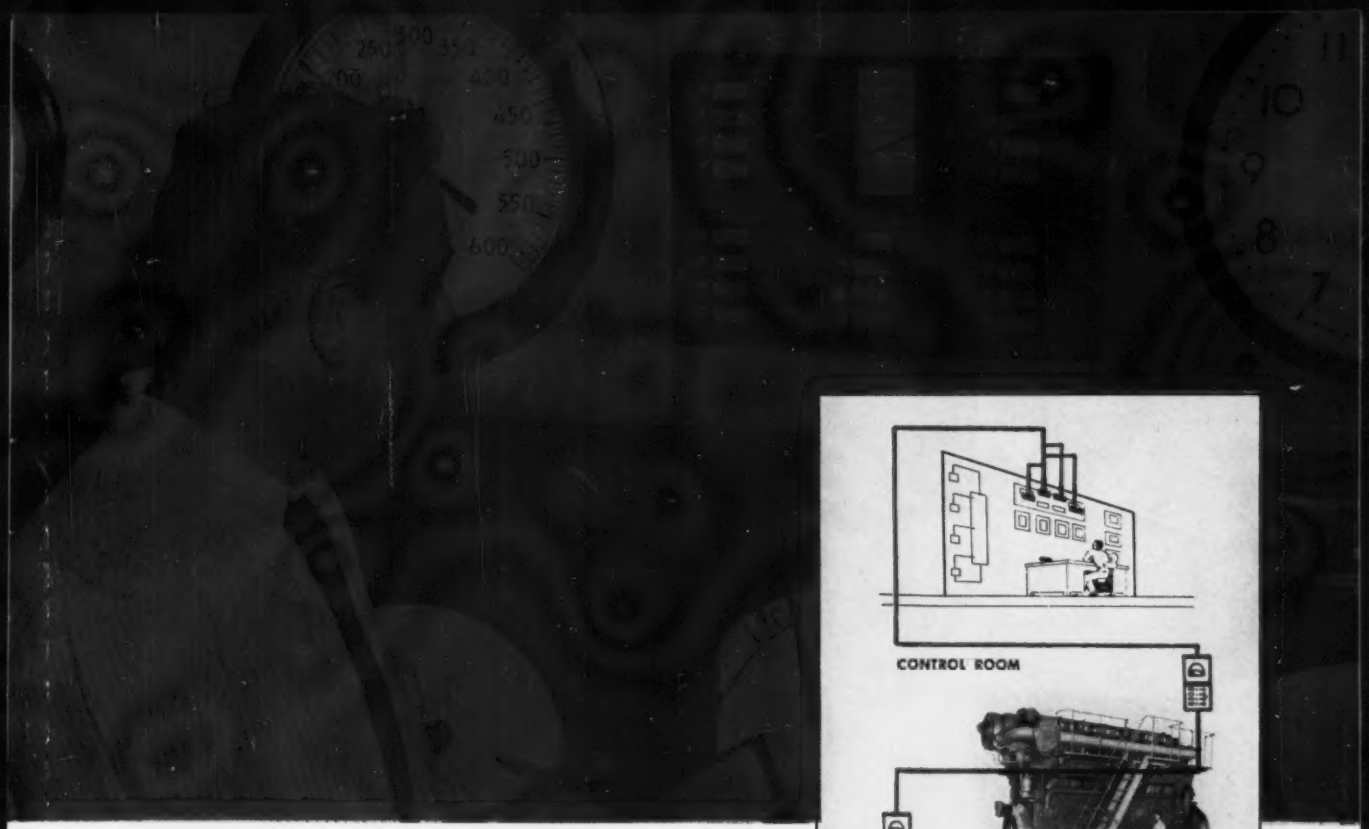

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EDISON

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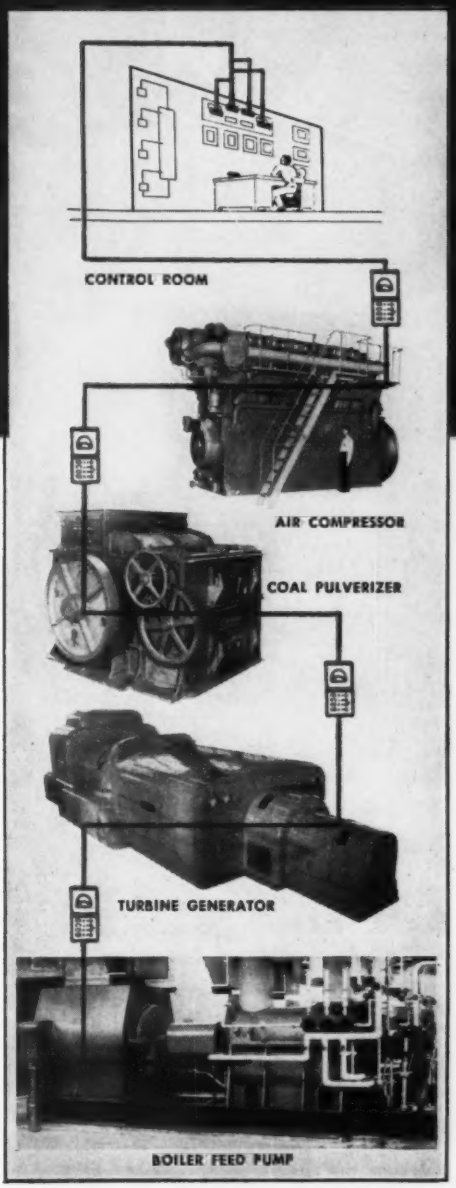
The Edison Omniguard system keeps constant watch on critical temperatures throughout electric generating plants. Omniguard monitors such vital temperatures as those of bearings on the main turbine generator, fluid drives, coal pulverizers, main feed pumps and other vital auxiliaries.

When overheating occurs the alarm sounds *before* damage occurs and corrective action may be taken immediately.

By guarding against overheating the equipment runs at optimum efficiency, lasts longer and requires less maintenance.

This modern Edison system is a simple, reliable means of keeping equipment operating at full efficiency and protecting against emergency shutdown.

For additional information on Edison Model 310 Omniguard temperature monitor and the wide variety of detectors available for use on all types of auxiliaries, pressure vessels, tanks and pipe lines, write for publication 3036C.



Thomas A. Edison Industries
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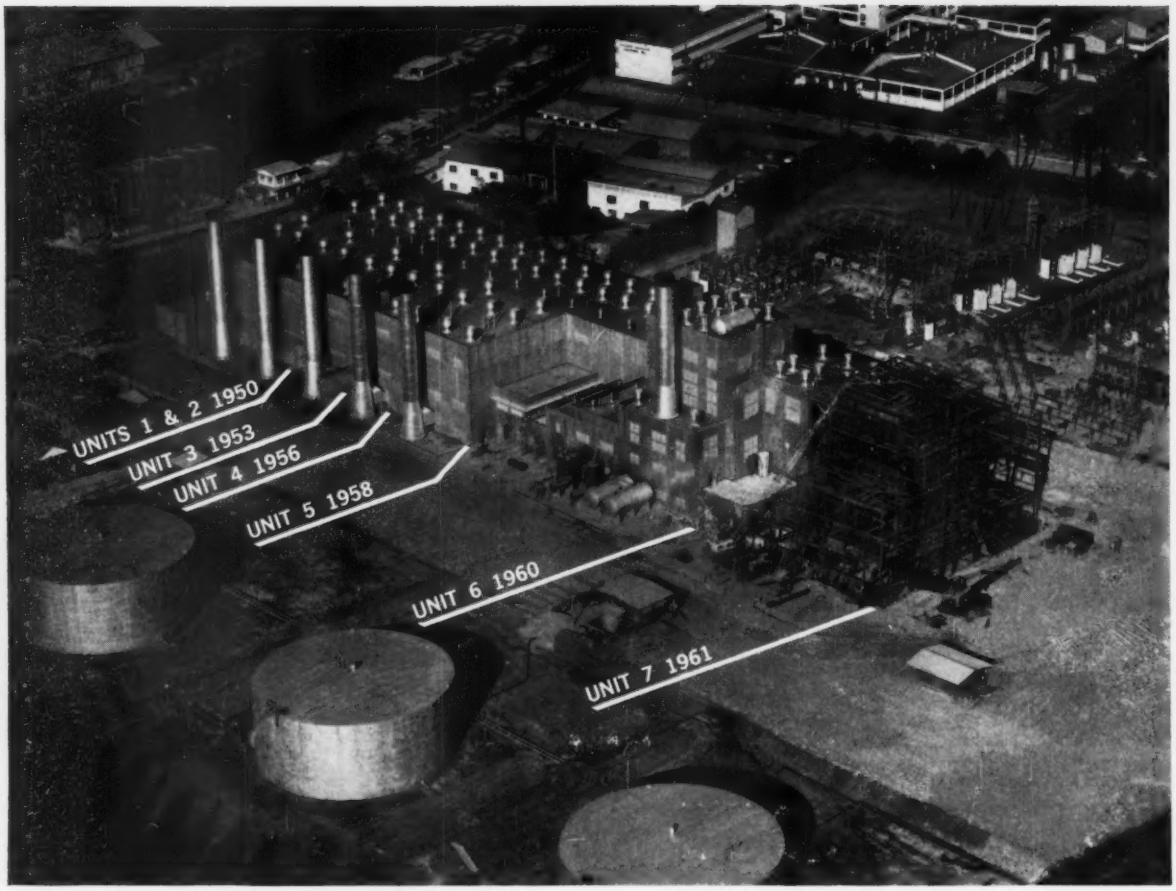

". . . AND THEN THERE WERE 6 7 "

Manila Electric Company had a generating capacity of 45,500 kw in 1941. During World War II this system was completely destroyed and its capacity reduced to zero.

At the end of the war, the Philippine economy was badly shattered and electric power was needed desperately. The salvageable portions of the damaged plants were rehabilitated as quickly as possible. At the same time, recognizing the future need for a much greater capacity, the Manila Electric Company began planning a new generating plant. Designs were completed and the first two 25,000 kw units at the Rockwell Station were put into operation in 1950. Since that time four more units have been added bringing the total capacity of this station to 185,000 kw. — the sixth unit completed in 1960 is rated 60,000 kw. An identical unit is now scheduled to go into service in 1961.

Rockwell Station, an outstanding contribution to Philippine economic progress, is also a typical example of how one client has, over a period of years, utilized the engineering services of Gilbert Associates, Inc.

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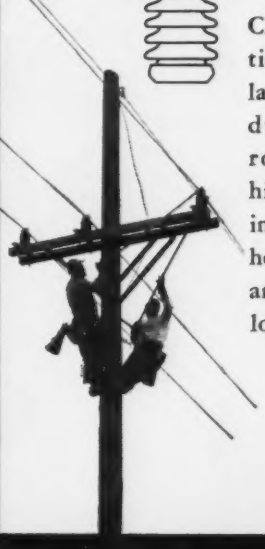
TIE-HEAD LINE POST

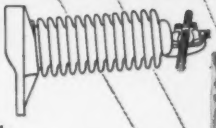
Up-to-date version of Lapp's original Line Post—the insulator with a 29-year service record of high-security operation. Inexpensive tie-wire installation provides a "mechanical fuse" when conductor breaks. New wide-throat conductor grooves on all units rated to 88 kv. The industry standard for most applications.

CLAMP-TOP LINE POST

Clamp attachment particularly adapted to large aluminum conductors with armor rods. Best for use in hilly terrain. Simplest installation, easiest for hot-line maintenance, and eliminates tie-wire loosening.

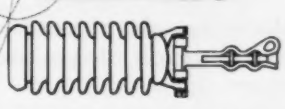


HORIZONTALLY-MOUNTED LINE POST

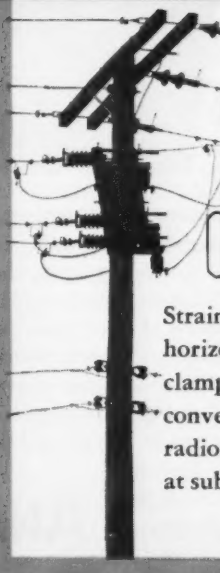


Save up to one-third in materials—more in labor of erection—with armless construction using Lapp Line Post with integral base-and-gain. Permits longer spans, larger conductors, greater safety margins. Eliminates contamination flashover, pole-top burning.

LINE POST FOR SLACK-SPAN DEAD-ENDS



Strain clamps supported by horizontally-mounted clamp-top Line Posts provide convenient, good-looking, radio-free slack-span support at sub-stations and line taps.



You'll find helpful data on use of a great variety of Lapp Line Post and Station Post Insulators in the new Lapp Catalog No. 8. Write for your copy.

Lapp Insulator Co., Inc.
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Maintain a low power factor by keeping the insulating oil clean, stable, and efficient. Because copper, oxygen and heat are present, the insulating oil in any paper insulated cable is subject to oxidation and gives off products that increase power factor. Anaconda greatly reduces this power factor increase by wrapping each conductor and the insulation in highly adsorbent carbon-black tapes. These patented tapes adsorb the oxidation products that the oil develops, keeps them outside the dielectric field. Result—the oil remains clean, pure and dielectrically stable far longer.

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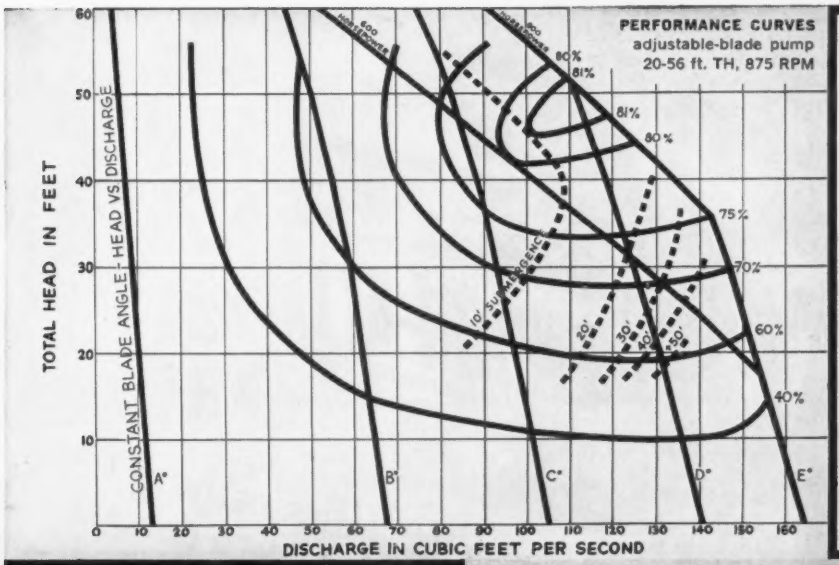
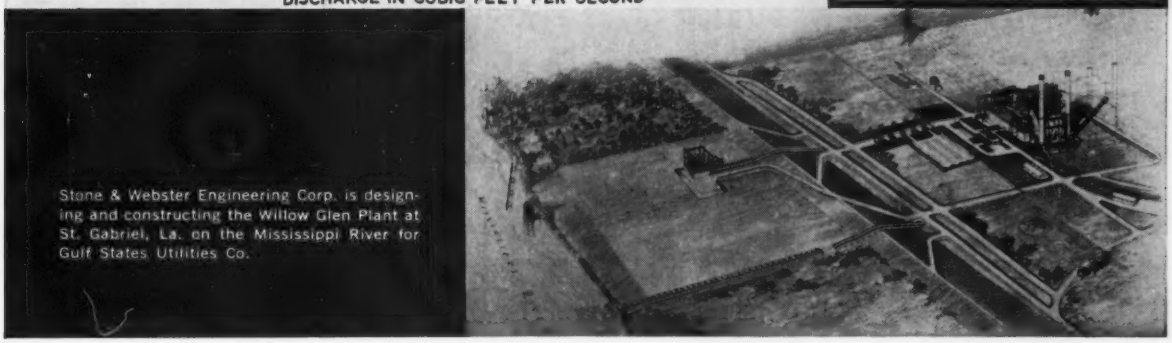


Performance curves of the A-C adjustable-blade axial flow pumps for Willow Glen illustrate their extreme flexibility. Pump operation is not restricted to a single head-discharge curve as is the case with fixed-blade pumps, but provides any discharge and head combination within the limits of motor horsepower and proper submergence.



Stone & Webster Engineering Corp. is designing and constructing the Willow Glen Plant at St. Gabriel, La. on the Mississippi River for Gulf States Utilities Co.

Flexibility and efficiency make Allis-Chalmers adjustable-blade pumps choice for Willow Glen

Two 30-inch Allis-Chalmers adjustable-blade axial flow pumps provide condenser water for Unit #1 at the new Willow Glen Power Station. To meet requirements at minimum river level, with water temperatures that vary between 39°F and 90°F, the pumps were designed to deliver a total of 76,000 gpm against a 54-foot total head.

Extreme variation of suction pool elevation and the flexible condenser operation required for this station made adjustable-blade pumps the logical and economical choice. A-C adjustable-blade pumps attain relatively high efficiencies over a wide discharge and head range. This is accomplished by varying the pitch of the impeller blades while the pump is operating at constant speed. This adjustability keeps pumping costs at a minimum by combining low starting torque with high average efficiency.

Pump Bulletin 165 will give you complete information on high capacity axial flow pumps. To get your copy, write to **Allis-Chalmers,** *Hydraulic Division, York, Pennsylvania.*

ALLIS-CHALMERS

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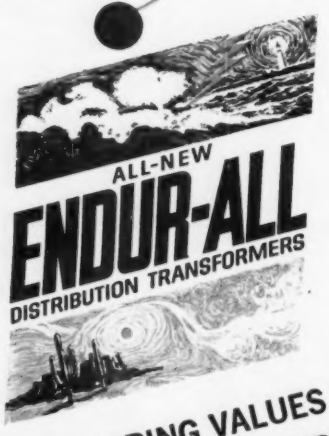

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New! Even more overload capabilities with high-temperature insulated wire.

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New! High short-circuit strength with automatic compression and locking of end-frame assembly.

New! 32 potential trouble-makers eliminated in core-and-coil end-frame assembly. No nuts, bolts, washers to lose, no welds to break.

New! Easier to handle and hang — units are 10% smaller and lighter.

New! High-gloss appearance and longer retention life with 3 baked-on paint coats.

New! Improved seal — nonaging, nonsetting gasketing.

New! Series-multiple switch — for lower changeover cost when making distribution voltage conversion.

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Editorial Comment

JUNE 5, 1961

Edison Enters Hall of Fame

Thomas Edison has been received into the Hall of Fame for great Americans. To millions of his countrymen, who honor him every day by their use of his inventions, this probably won't come as a great surprise. The Hall of Fame, however, is a singular honor reserved for the truly outstanding. And as Edison enters, the entire electric industry shares in the accolade.

But there can be a danger in honoring such a man. Often, after the statue has been in place for a number of years, we begin to think of the person as superhuman, someone to whom success came naturally. We forget the difficulties, the hardships, the criticisms, and yes, the failures, that blocked his path day in and day out.

It would be tragic if this were to happen to Edison. To us, the important lesson to be learned from his life is just how much a thoroughly human person can accomplish in the span of a few short years.

For this reason, we have written no eulogy. Instead, we have gone back to the publications of his own day, and have quoted some articles written while Edison was working on his electric light. These excerpts show not only his success, but also hints at the many roadblocks that beset his work. His greatness was his ability to roll aside these roadblocks.

Edison told us his secret: "Two percent inspiration and 98% perspiration."

Milestone Reached: One Million Electrically-Heated Homes

There are now over one million electrically-heated homes in the US.

Passage of this milestone is easily deduced from *Electrical World's* latest Electric Heating Survey (p 57). It means, by conservative assumption, that the total electric usage of these homes now accounts for around 10% of all residential usage. And this is with only 2% saturation!

By this decade's end, the nation's utilities tell *Electrical World,* there will be over five million electrically-heated homes, plus 450,000 commercial buildings and 40,000 industrial plants.

Thus is the growing impact of electric heating becoming evident. The largest single residential load ever undertaken by the utilities, electric home heating has come of age.

Progress is gratifying. But the estimate for 1969 still falls short of many optimistic predictions previously made.

The Survey shows conclusively that the phase where it was necessary to convince power suppliers of the need for electric heating has passed. The next phase must concentrate persuasive and educational efforts on those outside the utilities. Here the major effort must come from the utilities themselves.

This is no time to relax and assume the snowball has begun to roll of its own momentum.

This is the time for the utilities to increase their promotional and educational attack.

(*More Editorial Comment on next page*)

First Antitrust Consent Decree Tries to Dump Pendulum

At press time, the first judgment under the antitrust civil suits has been signed (p 43). The Justice Dept hopes it will be a model for all consent decrees they sign with electrical equipment manufacturers involved in the earlier criminal cases.

With one important exception, it appears that the decrees won't go beyond present interpretations of the various antitrust laws. Thus the fear that they might put additional hampering restrictions on ethical business communications and procedures seems in general unfounded. Moreover, the prototype decree reveals the government's concern lest the pendulum of "free" competition swing too far and thus injure some competitors.

As expected, the first decree tells sellers not to combine to: discuss prices (or pricing methods), reduce competition, allocate business, rig prices or bids, or squeeze out other sellers. Sellers can't reveal prices to other sellers before general release to the trade, or reveal bids or quotes to other sellers before opening or due date.

On the other hand, the decree prohibits selling at "unreasonably" low prices, with intent to stifle competition, or even (and here's where it goes beyond present interpretation of the laws) "where there is reasonable probability" that that would be the effect. Moreover, the defendant for ten years must separately itemize calculated prices (of his products covered by decree) which are components of any single-price combination bid or quote.

Also as expected: defendants must recalculate and publish new book prices "based on lawful considerations" within a year. And the way is smoothed for the Justice Dept to require reports and gain access to records.

Vagueness of the new "unreasonably" low price stricture in the "reasonable probability" of competition-stifling clause, may well cause some to argue the wisdom of its inclusion in this form.

Generally, however, the first decree, far from throttling ethical business intercourse, seems designed to prevent the competitive pendulum from swinging too far either way.

Manufacturers Present 'Value' Story

Four electrical equipment manufacturers have released a documented, graphically illustrated report on historical trends in values and prices of their products. This week (p 83), we condense the "value" chapter of the report. Next week we'll follow with the "price" story.

The value story presents little really new information. But it collects well-known trends into a compact package, and presents them in a form that to us has newly-dramatic impact.

We've said (EW, Mar. 6, 1961, p 23) that the antitrust damage claims would give the manufacturers opportunity to demonstrate their remarkable contributions. In part, the value reports fulfills the opportunity. It attempts to evaluate the worth of technological advances over the past 20 years, to utility, consumer and investor.

Certainly, it is not meant in any manner as a legal defense to damage suits. Yet the inference can be drawn that prices so low as to choke the flow of research and development would have slowed the remarkable achievements cited.

The results of this long-term program to reduce utility costs through greater equipment value have been possible only through combined effort of utilities and manufacturers. Significant reduction of such combined effort, especially with today's competitive forces and increasingly-complex technology, could cause irreparable damage to the combined industry.

First Consent Decree Signed

- Wheeler agrees to restraints but GE holds out; others wait
- Commerce chief to follow Cordiner before Kefauver probe
- More damage suits filed in Los Angeles and Phoenix

The US Justice Department is getting strong resistance from General Electric Co on the scope of the consent decrees Justice wants GE to sign as a result of the Philadelphia antitrust cases.

The 20 criminal cases were settled last February when Federal Judge J. Cullen Ganey sentenced 29 companies and 45 individuals for violation of the Sherman Act. The consent decrees at issue now will settle without trial the companion civil suits filed at the time of the indictments. In one case, involving open fuse cutouts, no civil suit was filed.

The main issue between GE and the government now is a clause that would prevent GE from selling at "unreasonably low prices." This same clause was used in the first (and to date, only) consent decree signed by a defendant in the Philadelphia cases, the C. H. Wheeler Manufacturing Co in the steam condenser case.

That clause reads that Wheeler is restrained from "selling condensers at unreasonably low prices with the purpose or intent, or where the effect is, or where there is reasonable probability that the effect will be, substantially to injure, suppress or stifle competition or tend to create a monopoly."

According to Justice Department lawyers, the purpose of this clause is to prevent big companies from attempting to drive small competitors out of business by means of predatory prices. And from further wording in the Wheeler decree, the burden of proof would be on the defendant to prove that its prices were not "unreasonably low" in any subsequent civil suit filed in this regard.

For GE, because of the vagueness of the meaning of "unreasonably low," operating under a decree of this kind would be difficult and would tend to stifle or nullify its present efforts at lowering costs and prices, the company believes.

For another thing, in signing the decree the company would be agreeing not to do just the opposite of what it was originally accused of doing: charging high and artificial prices. Reports from Washington have it that GE is so concerned about this clause that it might rather go through with the civil trials than sign the decree.

So far, there are no reports of other companies involved raising any serious objections to this or any other clause, but evidently they are waiting for GE to sign before signing themselves.

Other Wheeler Restraints

There are other clauses in the Wheeler decree which are aimed at protecting the smaller competitor, and which presumably will be included in the remainder of the decrees.

One requires Wheeler, for a period of ten years, to itemize separately the price of condensers in any combination or packaged bids. The Justice Department says this clause is designed to protect the small manufacturers, who bid on only one component, against large companies who bid on a complete job.

At present, Justice says, without a breakdown by a large company on the price of its components, the small company has no way of knowing what price its large competitor is charging for the part it wants to bid on. A breakdown of prices would give it some idea.

Westinghouse Electric Corp has agreed in principle to this clause, but feels it needs to be clarified further from the point of view of clerical administration.

Another provision in the Wheeler decree aimed at helping small competitors, says that competing condenser manufacturers that buy condenser parts from Wheeler have to get the same terms of sale unless Wheeler can show it has discriminated "in good faith to meet an equally low price of a competitor, or did not have the effect of substantially lessening competition."

Some of the Philadelphia defendants said they were forced to participate in illegal meetings for just this very reason: discrimination by competitors selling parts to them.

On sealed bids to governmental agencies, the decree says Wheeler, if so requested by the buyer, must furnish an affidavit of non-collusion signed by the person responsible for preparing the bid, and, where feasible, signed also by his supervisor.

On prices, Wheeler is directed within a year to review and determine its book prices individually and independently, and to announce such prices.

Other provisions follow the usual pattern of consent decrees. Judge Ganey approved the Wheeler decree May 22.

Kefauver to Hear Hodges, Cordiner

Meanwhile, in Washington the Senate Antitrust & Monopoly Subcommittee has rescheduled GE Chairman Ralph Cordiner's appearance before it for June 5. The following day the Subcommittee will hear from Secretary of Commerce Luther Hodges as it begins to wind up its probe into the electrical industry. Hodges will comment on the principles of the antitrust laws, the role of competition in the economy, and the value of business ethics, a Subcommittee spokesman said.

Cordiner's appearance before the Subcommittee late last month was cancelled because of the press of Senate business.

The outlines of antitrust legislation that Sen Estes Kefauver (D-Tenn.), the Subcommittee's chairman, will introduce are now becoming apparent. First, he will ask for stiffer penalties for violation of the antitrust laws. Second, he will ask for a spreading of responsibility among the corporate hierarchy when antitrust laws are violated. Third, he will propose that the rules of evidence be changed so that identical bidders would have to prove that they did not collude

rather than the government having to prove that they did collude. The first two proposals are now in draft form; the third is more tentative.

More Damage Suits Filed

Three more damage suits have been filed by buyers of equipment which was involved in the Philadelphia antitrust cases.

In Los Angeles, the Department of Water & Power is seeking $3,447,800 in a suit covering distribution transformers. Defendants are General Electric Co, Westinghouse Electric Corp, Allis-Chalmers Manufacturing Co, Kuhlman Electric Co, McGraw-Edison Co, Moloney Electric Co, and Wagner Electric Corp.

In a suit on meters, LADW&P is asking $2,715,480 from GE, Westinghouse, and Sangamo Electric Co.

In Phoenix, the Salt River Project is asking for $19,688,250 from GE, Westinghouse, and Allis-Chalmers in a suit covering turbine-generators.

Los Angeles and Salt River have now filed a total of three triple-damage suits each, totaling $10,133,080 and $26,202,420 respectively.

More Staff Recommended for Interior Dept

More freedom and advisers are needed by the Interior Department's secretarial level to make research, policy and planning decisions, says a special report by Resources for the Future, Inc.

This report, requested by Interior Secretary Stewart Udall, claims, "In many instances, the country is falling behind the current needs (in natural resources) because programs are either insufficient or misdirected," and it advises Udall on how this can be corrected within the Department, including power policies.

"Federal generation of hydroelectric power and preference in its marketing through municipal, public cooperative distribution systems is an important means of regulating rates and service of private power companies," the report states.

And it points to three "emerging factors" which have "profound bearing" on this concept:

- Hydroelectric potential is becoming a smaller fraction of total power capacity;

Steam-Hydro Integration Needed

- Advances in steam power technology have made hydro, "both regular and pumped storage," most valuable for serving peak loads, and "this means that if best use is to be made of federal hydro, it must be integrated with steam."
- High-voltage transmission has opened "new opportunities" for advancing the "economic efficiency of power supply."

As to the duties of the Secretary, Under Secretary and Assistant Secretaries, the report recommends:

- Science, economic advisors and other "strong staffs" for secretarial use;
- Continuing appraisals of the natural resources demand-supply outlook:
- Studies of resources investment and regional economics;
- Creation of a policy and program committee.

This last committee would be similar to the Special Projects Committee which was set up in the Department during the last days of the Truman Administration. Former Interior Assistant Secretary Girard Davidson had testified earlier this year that "it was well nigh impossible to consider a resource problem in its entirety, objectively, with broad perspective and imagination" while he was in office. Davidson had supported the special committee, but it failed for lack of full Departmental support shortly afterward.

The new report also recommends against "radical changes" in the present responsibilities of the Department's assistant secretaries, but adds: "The secretariat should provide leadership in policy-making and program development . . . to do this, they must avoid becoming enmeshed in details. . ."

President Studies Nationwide NEAR System

President Kennedy is considering a special request to Congress for $50 million to install, on a nationwide basis, the proposed Nuclear Emergency Alarm Repeater (NEAR) system, using electric systems for its operation.

The NEAR device, proposed by the Office of Civil and Defense Mobilization, has been tested in Michigan, principally on the lines of Consumers Power Co.

Chances are good that, if Kennedy does call for the system to become operational, it will be transferred from OCDM to the Defense Department.

Meanwhile, OCDM plans to award a contract shortly for study of the best installation sites for the NEAR transmitters on electric systems. The study would be in Michigan. The OCDM contract would be for $70,000 this fiscal year, and might be raised to $400,000 in fiscal 1962, beginning July 1, out of funds to be made available for the device in both the Eisenhower and Kennedy budgets.

A statewide test of the NEAR system has been proposed by OCDM before the end of this year. Earlier, small-scale tests on the Consumers Power system were highly successful, says OCDM. In addition to the study contract and the statewide test, OCDM is reviewing the legal and mechanical details of installing federally-financed alarm transmitters on non-federal systems.

The NEAR system is based on central stations sending out 240-cycle impulses from special transmitters, activating individual home receivers. While the federal government would spend about $50 million on the alarm transmitters, homeowners would have to install receivers at their own expense—probably between $7.50 and $10 per receiver.

British Government to Probe Power Outage

A full-scale inquiry by the British government will be held into the reasons for the May 15 power failure that blacked out southeast England, including most of London, Kent, Sussex, and Surrey, for periods of up to three hours.

When the failure occurred at 9:30 in the evening, mainline London railway stations came to a standstill as signal lights failed; street and traffic lights went out, slowing traffic to a crawl; newspaper production was stopped; radio and television transmissions were halted; and some 2,000 miners were trapped a mile underground in a Kent coalmine.

The trouble started when a ground fault occurred on a 132-kv line south of London, but precise location or cause of the fault is still undetermined.

The resulting surge caused another line to trip erroneously and resultant cascade tripping soon caused collapse of the system. All feeder circuits were then opened and within a half an hour the dispatcher started putting power stations back on the lines.

At the time of the fault, the area affected was carrying 2,810 Mw of load, of which 2,050 Mw was being generated within the area, and 760 Mw was being imported from surrounding areas. When the fault occurred, 1,500 Mw of load was lost.

System condition contributing to the failure, according to *Electrical World* overseas correspondent J. H. M. Sykes, was the heavy amount of maintenance being done on the system at the time, so that too many generating plants and transmission lines were off the system. Behind this is still another reason: the great shortage of transmission capacity caused in large part by the unwillingness of Kent landowners to grant right-of-way, particularly for 275-kv lines.

When interviewed by Sykes after the failure, Sir Christopher Hinton, head of Britain's Central Electricity Generating Board, said that for the long term the CEGB would step up its efforts to get rights-of-way for 275-kv lines in Kent. For the short term, all maintenance work was being stopped.

Prior to that, in a statement hurriedly issued, the CEGB said, "Certain transmission lines and generating sets were out of commission for normal summer overhaul, but planning of these 'outages' had been done with due regard to the security of the system."

The government investigation will attempt to determine why this evidently was not the case on the night of May 15.

Dc Considered for BPA-California Tie

Interior Secretary Stewart Udall's five-man task force investigating the proposed Bonneville-California 500-kv tie has expressed a strong interest in dc transmission. In its recent progress report to the Administration, the task force recommends "the construction as soon as possible, under government leadership, of full-scale test installations of high voltage dc terminal equipment and a substantial length of line."

A lack of experience in frequency control and reactive generation and absorption for high capacity transmission lines longer than 300 miles is cited as favorable to the long-term advantages of dc transmission. The technical feasibility of 500-kv ac lines is conceded, however, and the report emphasizes that construction of such a line could be started immediately.

Recommendations Not Final

No final recommendations are made. But the question is raised of the desirability of designing a 500-kv line which could incorporate features for future dc operation. The task force suggests that a suitable dc test program could be undertaken in cooperation with interested American manufacturers.

The report states that economic studies indicate possible savings in dc construction if distances are over 300 miles and blocks of power exceed 500 Mw. Proposals have been obtained in preliminary form from General Electric Co and ASEA Manufacturing Co (Sweden) for dc terminal equipment operable in the range of 600 to 800 kv (300 and 400 kv positive and negative to ground).

Russia Says It Plans 1,500-Kv Dc

Moscow—Preliminary plans have been drawn up in Leningrad for a dc power transmission line which the Soviets claim will operate at 1,500 kv between the Urals and hydroelectric stations being built in Siberia.

Tass claims use of dc instead of ac on the line, which will extend some 1,500 miles from the Bratsk and Krasnoyarsk power stations, will cut construction costs by a third and reduce power losses substantially.

Problems connected with the project are being studied at the Leningrad Alternating Current Research Institute. A 1,300-kv unit has been installed there for testing cable insulation and other equipment for the 800-kv dc transmission line, now under construction, which will link Stalingrad and the Donbass.

Airing of Federal Power Proposals Set

Opponents of a proposed federal "backbone" transmission grid for the Upper Colorado power project will have their day in court June 6 in closed hearings by the House Appropriations Subcommittee on Public Works. The House unit has scheduled 75 minutes Tuesday for testimony against the federal lines by outside witnesses; and it has set 75 minutes also for other outside witnesses who favor the federal lines.

Upper Colorado lines are expected to draw the most testimony —both for and against—in the Subcommittee's week-long hearings (June 5-13) on a proposed federal public works budget for fiscal 1962.

Other important projects to be discussed are the Bureau of Reclamation's Trinity transmission lines, connecting that project with the Central Valley System, and a line between Keswick and Toyon, Calif.; also the proposed Hanford nuclear generating plant.

The full House Appropriations Committee probably won't report out its public works appropriation bill until the end of June, and printed copies of the closed hearings will be released at that time.

The Kennedy Administration has already testified in favor of these projects during May. This will be its first test on some controversial projects — winning Congressional support to finance them.

Prominent in the controversy is a $5-million request to finish planning and start work on a high-voltage (230, 345-kv) federal transmission grid connecting the Glen Canyon, Flaming Gorge, and Curecanti projects with load centers in Utah, Colorado, Arizona, New Mexico and Wyoming. Eventually, the federal grid will cost about $150 million.

Five Mountain States utilities had proposed an alternate plan whereby they would construct most of these lines and wheel power for the Bureau (EW, Nov. 30, 1959, pp 86-89). But outgoing Interior Secretary Fred Seaton recommended against this plan in January, and Interior Secretary Stewart Udall affirmed this decision later this year. The companies will now appear before the House Subcommittee to explain their proposal and describe how it would be more economical to the government than construction of federally-built lines. Both Seaton and Udall had based their recommendations on a report by Reclamation Commissioner Floyd Dominy, which showed the federal plan more economical in the long run than the private plan.

Public power groups will be testifying also during the week-long hearings on the whole gamut of power issues. These include the American Public Power Assn and the National Rural Electric Cooperative Association.

The Bureau of Reclamation also is seeking $279,500 to start work on a 115-kv transmission line between Keswick and Toyon, Calif., to serve the Shasta Area PUD; and the Bureau also is asking for $5 million to start work on a 230-kv line between Cottonwood and Tracy, Calif., in addition to $7,220,000 to continue work on its Trinity-Cottonwood transmission line.

Bonneville Power Administration is seeking $410,000 to start work on adding transmission lines for Hanford.

And the Bureau is seeking $300,000 to study transmission line interconnections between regional federal systems plus another $500,000 to step up investigations of other potential Bureau of Reclamation projects.

Bonneville, Southwestern, Southeastern Power Administration, the Bureau and Corps of Engineers, Tennessee Valley Authority and Atomic Energy Commission are all seeking budgets for fiscal year 1962 in the closed hearings. Later this summer, after the House has approved its public works bill, the Senate Appropriations Committee will hold open hearings on the budget requests.

Basin Power Integration Studied

Integration of thermal and hydro power generating capacity in the Missouri River Basin is being studied by the Bureau of Reclamation, Assistant Interior Secretary Kenneth Holum told the Missouri Basin Inter-agency Committee at Yankton, S. D.

Also, Holum said the Bureau is studying possible construction of an added tie line between the basin's eastern and western divisions for fiscal year 1963—probably to be built between Yellowtail and Oahe Dams.

Holum said the Bureau would be able to supply firm power needs to Missouri Basin preference customers through 1965, and has a special committee working with the Midwest Electric Consumers Assn, National Rural Electric Cooperative Assn, and the US Army Corps of Engineers on ways to solve the Bureau's lack of capacity to provide still more firm capacity.

He also said preliminary studies showed that reserve arrangements could be worked out with public systems in the area to support "comparatively large thermal units. This is especially true after the first few thermal units have been installed. Where there will be ample reserves in the early years to support 150 or 200-Mw units is still to be determined." Under this arrangement, the Bureau would furnish reserve hydro capacity, while the public systems would build the thermal plants.

Plans similar to the Mid-West Electric group have been proposed by a new group, the Basin Electric Power Co-op Assn (EW, May 22, pp 62-63), to construct 400 Mw of thermal generation capacity plus a series of 345-kv transmission lines to the Basin Electric's membership of 15 distribution-type co-ops.

TVA Plans New Bond Issue

Tennessee Valley Authority has announced plans for its second $50-million bond issue under 1959 enabling legislation. Offering will be on June 28 at competitive bidding. The first $50-million issue was sold last November.

Hall of Fame Welcomes Thomas A. Edison

Edison joins Hamilton, Lincoln, Howe, and other great Americans as an inspiration to all men the world over

■ Standing above the Northern Gate of the Hall of Fame are the words, "Enter with Joy that those within have lived."

The phrase spells out the purpose of the Hall—to remind men of the contributions that Americans have made to science and the arts. It is a place of inspiration, open to the public, where a person can pause, surrounded by the mementos of great lives. And now, among these lives is that of Thomas Edison.

To be eligible for election to the Hall of Fame a person must be deceased for at least 25 years. This is to insure that the sober judgment of time confirms the verdict of contemporaries that the individual is truly worthy. Since balloting is held every five years, Edison, who died in 1931, first became eligible for selection in 1960. A total of 142 electors cast their votes. According to the Hall's constitution, a majority, or 72 votes, was necessary for selection. Edison received 108 ballots.

If Edison were being received into any other memorial, the honor paid to his genius and work might well be less significant. Frequently such shrines are parochial in scope, and confuse local notoriety with world-wide fame.

In 1864, for example, each state was invited to choose two persons for installment in a national hall of statuary. "The method of choosing them, by state legislatures," wrote Robert Johnson in his book "Your Hall of Fame," "was certainly not conducive to promoting an impartial selection." It is quite possible that the names or lives of the men represented would not even be known, much less stand as a source of inspiration, to people today.

But the Hall of Fame, under the care of New York University, has avoided such pitfalls. For one thing, it hasn't become the family monument to any particular class or profession. Many European halls, established to pay tribute to the great, have been dominated by the heirs of a particular bloodline, or by the saints of a national church.

Then there is always the danger that the guardians of such a hall may open its doors to heroes of the day, mistaking the current idol for a person of enduring fame. Such a mistake can turn a national shrine into a national carnival.

Proof that the Hall of Fame has not degenerated in this way is to be found more in the people it has excluded than in those it has received. Many strong figures in our history, John C. Calhoun, Horace Greely, Samuel Adams, John Jay, John C. Fremont, and Henry George, despite the majesty of their accomplishments, have nevertheless fallen short of the standards set by electors.

To the mind of the electors, then, the accomplishments of Edison exceed those of Calhoun, Jay, Fremont, and George. He takes his place with Alexander Hamilton, Samuel L. Clemens, David Farragut, Elias Howe, Robert E. Lee, and Abraham Lincoln. Like these men, his life will stand as an inspiration to the world.

Dr Henry van Dyke has defined fame as "a durable good renown, earned by service, approved by the wise, and applauded by the common voice." In entering the Hall of Fame, Edison's renown is approved by the wise. It seems unlikely that the millions who benefit each second from his genius will withhold their applause.

Edison Illuminates Lower Manhattan

Contemporary journal reports birth of the electric light; lighting of business area shows Edison's idea practical

■ *Electrical World* has been around for a long time. But it hasn't always been called "Electrical World." In the 1870's such a title would have been pretentious, for electricity was only a small part of the world men knew and worked in. Its chief use was for telegraphy, and the magazine of the industry, which later grew up to be *Electrical World,* was called the *Operator.*

As you thumb through copies of the old *Operator,* you begin to catch the mood of the times. Hayes is president of the United States, having defeated Tilden when the electoral college reversed the popular vote. Victoria is Queen of England, and Bismarck's army has returned from Paris. The automobile hasn't been invented yet. Balloon flights are a fairgrounds curiosity but some are predicting that air transportation may be in the future.

Readers of the *Operator* are hearing about the latest technological developments in telegraphy. One article asks, "How many wires should be worked from one battery?" Another begins, "Telegraphy is to be revolutionized once more. Professor Loomis thinks it possible to send messages without wires, by means of aerial currents."

They're also beginning to read about uses of electricity outside the field of telegraphy. One farmer speculates that he may run an electric current through his wire fence to keep lazy field hands from sitting on it. A jurist wonders if the mysterious current might be used for the execution of criminals.

Electric Light Impractical

The *Operator* has been giving space to various attempts to use electricity for lighting. But so far it seems impractical. For one thing, scientists are sure that electricity is indivisible.

When you hook two lights to the same line, each burns half as brightly as it did alone. Secondly, the lamps only last a few hours. You'd spend all your time just changing the lamps, if you could afford the supply. They're pretty expensive.

Telegraphers are also familiar with the name Thomas Edison. He was a telegrapher himself, but for the past ten years he's been an inventor and he has done some amazing things with electricity. His stock ticker is used all around the business district of Manhattan. He improved the telephone so that you can hear something on it, and his phonograph is just amazing.

Enter Edison

Then, in November 1878, you read in the *Operator* that Edison and the electric light are getting together. And Edison isn't just doing some laboratory work on the light. Already he has filed articles of incorporation for the Edison Electric Light Co, and is proposing to light the office buildings and dwellings of Menlo Park. According to the *Operator:*

"The electricity is to be made by 20 or more engines, stationed in different parts of the city. Instead of manufacturing all the electricity at one central point, as gas companies make gas, there would be 20 stations . . . It is thought that the engines will be powerful enough to furnish light to all houses within a circle of half a mile. The wires can be laid right through the gas pipes and thus brought into the houses . . . No match is needed to light it. A cock is turned, the electric connection made, the platinum burner catches the proper degree of heat, and there is light."

Perhaps Edison's plan strikes you as fantastic, the pipe dream of an inventor. But apparently some people are taking it quite seriously. According to the *Operator* a few weeks later:

"A perfect panic seems to have set in among the holders of gas stocks all over the United Kingdom. Investors in this kind of securities are now busy performing the useless operation of 'shutting the stable door after the horse has been stolen.' Some of the wisest of them sold out their stock the moment the electric light began to be seriously spoken of. Those who did not have now to cry over spilt milk . . . A ruined and distracted gas shareholder addresses to the *London World* the following letter:

'What trade can be safe while this terrible gentleman (Mr. Edison) is at large. Time is flying, and even now, having completed the ruin of the gas companies he may be turning his diabolical attention again to the telephone, which at no distant date, shall involve in the same fate unlucky holders of telegraph shares.'"

Naturally, you're waiting eagerly for word that Edison's light really works. But the days turn into weeks, and the weeks into months. Still no announcement of victory from Menlo Park. Some people are getting a little worried, and the *Operator* is filled with letters from subscribers who think that the young inventor has bitten off more than he can chew. One letter suggests that Edison is not so much interested in inventing the electric light as he is in manipulating the gas stocks for his own personal advantage.

Progress Is Slow

But Edison is making progress. By October 1879, he feels that he has licked the problem of dividing light so that many lamps can be made to give more light than one lamp. He's also fairly certain that electric light will be economical. Says the *Operator:*

"In conversation last week with a reporter, Mr. Edison, speaking of electric light, said: 'I have let other inventors get somewhat the start on me in this matter, because I have not given much attention to electric lights; but I believe I can catch up with them now. I have an idea that I can make the electric light available for all common uses, and supply it at a trifling cost compared with that of gas. There is no difficulty about dividing up the electric currents, and using small quantities at different points. The trouble is in finding a candle that will give a pleasant light, not too

by Electricity

intense, which can be turned on or off as easily as gas.'"

But still, the idea seems a little bigger than the public mind. Within a few weeks the New York correspondent of the *London Times* has reported that the Edison electric light is a failure. The *Operator* asks Edison.

"Mr. Edison emphatically denies the statements . . . to the effect that the Edison electric light is a failure. 'If lucky,' he says, 'we shall have all the houses in Menlo Park lit up in six weeks. The subdivision of light is perfect.'

Mr. Edison says that he shall burn 500 lights at Menlo Park, keeping them aglow night and day, until the stockholders are satisfied . . . Sixteen electric lights are now in use in Mr. Edison's machine shop."

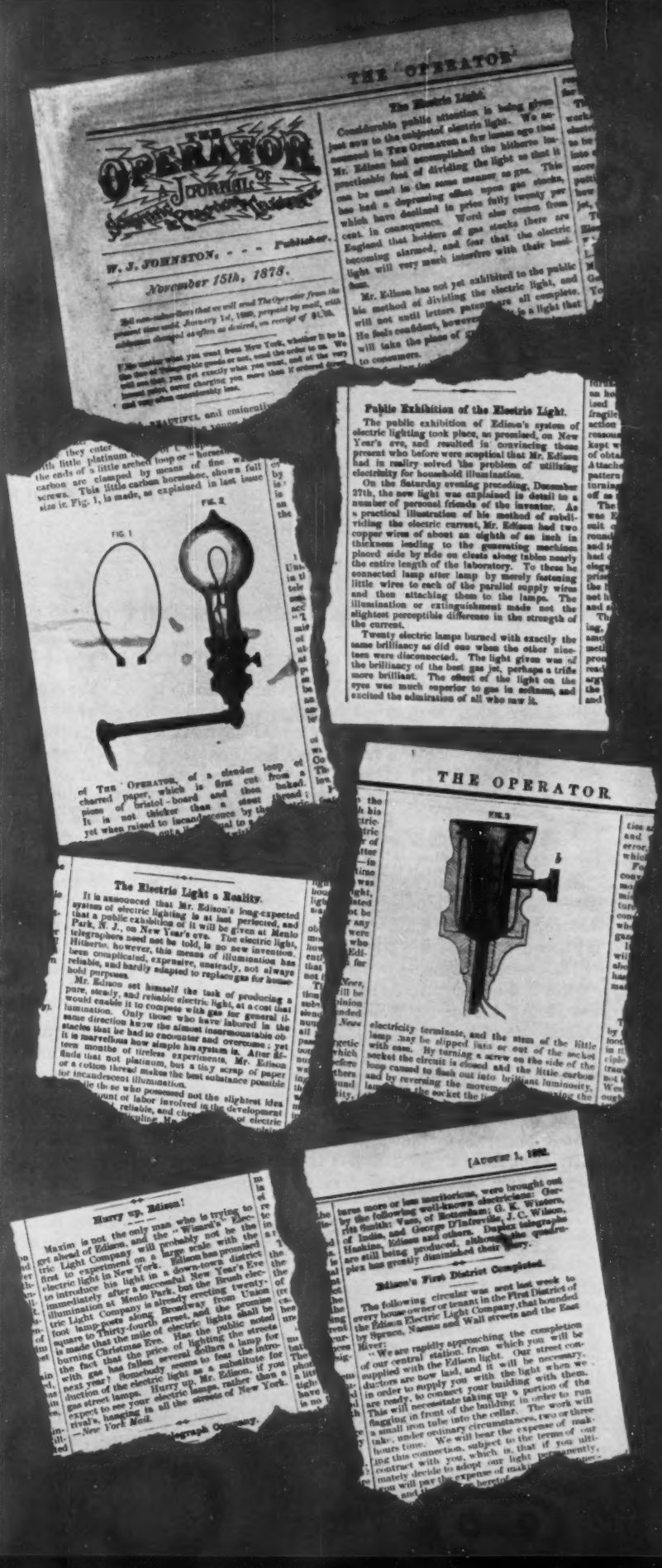
It isn't too long before the *Operator* is able to report that Edison has passed another milestone. In December 1879, you read:

"It is announced that Mr. Edison finds that not platinum, but a tiny scrap of paper, or a cotton thread makes the best substance possible for incandesent illumination . . . While those who possessed not the slightest idea of the amount of labor involved in the development of a practical, reliable, and cheap system of electric lighting were ridiculing Mr. Edison and complaining of the delay, the inventor was quietly at work, night and day, endeavoring to solve the important problem he had undertaken."

On Dec. 27th, Edison shows reporters from the *Operator* exactly what the public will see in Menlo Park a few nights hence.

"As a practical illustration of his method of subdividing the electric current, Mr. Edison had two copper wires of about an eighth of an inch in thickness leading to the generating machines placed side by side on cleats along tables nearly the entire

(*Continued on page* 89)


THE OPERATOR

The Electric Light.

Considerable public attention is being given just now to the subject of electric light. We announced in THE OPERATOR a few issues ago that Mr. Edison had accomplished the hitherto impracticable feat of dividing the light so that it can be used in the same manner as gas. This has had a depressing effect upon gas stocks, which have declined in price fully twenty per cent. in consequence. Word also comes from England that holders of gas stocks there are becoming alarmed, and fear that the electric light will very much interfere with their business.

Mr. Edison has not yet exhibited to the public his method of dividing the electric light, and will not until letters patent are all complete. He feels confident, however, that it is a light that will take the place of gas for domestic purposes to consumers.

Public Exhibition of the Electric Light.

The public exhibition of Edison's system of electric lighting took place, as promised, on New Year's eve, and resulted in convincing those present who before were sceptical that Mr. Edison had in reality solved the problem of utilizing electricity for household illumination.

On the Saturday evening preceding, December 27th, the new light was explained in detail to a number of personal friends of the inventor. As a practical illustration of his method of subdividing the electric current, Mr. Edison had two copper wires of about an eighth of an inch in thickness leading to the generating machines placed side by side on cleats along tables nearly the entire length of the laboratory. To these he connected lamp after lamp by merely fastening little wires to each of the parallel supply wires and then attaching them to the lamps. The illumination or extinguishment made not the slightest perceptible difference in the strength of the current.

Twenty electric lamps burned with exactly the same brilliancy as did one when the other nineteen were disconnected. The light given was of the brilliancy of the best gas jet, perhaps a trifle more brilliant. The effect of the light on the eyes was much superior to gas in softness, and excited the admiration of all who saw it.

FIG. 1

FIG. 2

of THE OPERATOR, of a slender loop of charred paper, which is first cut from a piece of bristol-board and then [illegible] It is not thicker than a sheet yet when raised to incandescence by the

THE OPERATOR

FIG. 3

electricity terminate, and the stem of the little lamp may be slipped into or out of the socket with ease. By turning a screw on the side of the socket the circuit is closed and the little carbon lamp caused to flash out into brilliant luminosity, and by reversing the movement [illegible]

The Electric Light a Reality.

It is announced that Mr. Edison's long-expected system of electric lighting is at last perfected, and that a public exhibition of it will be given at Menlo Park, N. J., on New Year's eve. The electric light, telegraphers need not be told, is no new invention. Hitherto, however, this means of illumination has been complicated, expensive, unsteady, not always reliable, and hardly adapted to replace gas for household purposes.

Mr. Edison set himself the task of producing a pure, steady, and reliable electric light, at a cost that would enable it to compete with gas for general illumination. Only those who have labored in the same direction know the almost insurmountable obstacles that he had to encounter and overcome; yet it is marvellous how simple his system is. After different months of tireless experiments, Mr. Edison finds that not platinum, but a tiny scrap of paper or a cotton thread makes the best substance possible for incandescent illumination.

[illegible] who possessed not the slightest idea of the amount of labor involved in the development of a practical, reliable, and cheap system of electric lighting, Mr. [illegible]

[AUGUST 1, 1882.

[illegible] terus more or less meritorious, were brought out by the following well-known electricians: Gerrits Batchir Vass, of Rotterdam; G. K. Winters, of India, and George D'Infreville, J. C. Wilson, Hopkins, Edison and others. Duplex telegraphs are still being produced, although the quadruplex has greatly diminished their [illegible]

Edison's First District Completed.

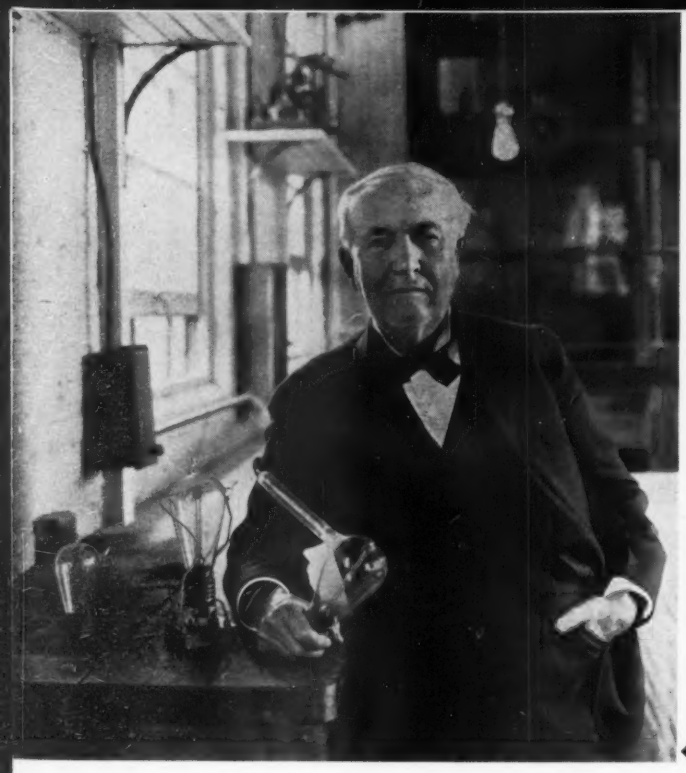
The following circular was sent last week to every house-owner or tenant in the First District of the Edison Electric Light Company, that bounded by Spruce, Nassau and Wall streets and the East River:

"We are rapidly approaching the completion of our central station from which you will be supplied with the Edison light. Our street conductors are now laid, and it will be necessary, in order to supply you with the light when we are ready, to connect your building with them. This will necessitate taking up a portion of the flagging in front of the building in order to run a small iron tube into the cellar. The work will take, under ordinary circumstances, two or three hours time. We will bear the expense of making this connection, subject to the terms of our contract with you, which is, that if you ultimately decide to adopt our light permanently, you will pay the expense of making [illegible]

Hurry up, Edison!

Maxim is not the only man who is trying to get ahead of Edison, and the "Wizard's" Electric Light Company and the "Wizard" himself will probably not be the first to experiment on a large scale with the electric light in New York. Edison has promised to introduce his light in a down-town district immediately after a successful New Year's Eve illumination at Menlo Park, but the Brush electric Light Company is already erecting twenty-four lamp-posts along Broadway from Union square to Thirty-fourth street, and the promise is made that the mile of electric lights shall be burning Christmas Eve. Has the public noted the fact that the price of lighting the streets with gas has fallen several dollars a lamp for next year? Somebody seems to fear the introduction of the electric light as a substitute for gas street lamps. Hurry up, Mr. Edison, if you expect to see your electric lamps, rather than a rival's, hanging in all the streets of New York.
—*New York Mail.*

CLIPPINGS FROM THE 'OPERATOR', which later became Electrical World, tell the story of Edison's struggle to perfect the incandescent light



Edison's Foresight Put Raw Ideas To Work

In a simple laboratory device for transmitting electric power, Edison saw the industrial systems of the future

THOMAS EDISON in his laboratory

■ Usually, Thomas Edison wasn't the first to come up with a new idea. Only when he invented the phonograph were there no previous patents for anything resembling his device. His real genius was in taking a raw, laboratory idea that already existed, and transforming it into a practical device for the service of society.

Edison told editors of the *Operator* that electric light, for example, was no new discovery. All he claimed was that he had found out how to utilize it. Often, in looking through the journals of his time, we find Edison coming upon the discarded toy of another man, and seeing in it a whole new world of progress.

The *Operator* related this incident concerning Edison: "While visiting the mining regions of the Sierra Nevada and Rocky Mountains in his late Western tour, Prof. Edison was struck with the difficulty there had by miners in drilling and boring, though in many cases in the vicinity of rapidly flowing mountain streams . . . Turning to his intimate friend, Prof. Barker of the University of Pennsylvania, he exclaimed abstractly, 'Why cannot the power of yonder river (pointing to the Platte River on a plain a thousand feet below) be transmitted to these men by electricity.' This thought seemed not to go far from Edison's head."

Edison Sees a Laboratory Device . . .

A short time later, Edison was invited to see a machine made by William Wallace, for the transmission of electricity. The *Operator* tells us:

"This filled up Mr. Edison's cup of joy. He ran from the instruments to the lights, and from the lights back to the instrument. He sprawled over a table with the simplicity of a child and made all kinds of calculations. He calculated the power of the instrument, and of the lights, the probable loss of power in transmission . . ."

Years later, when the *Operator* had become *Electrical World*, Edison was interviewed concerning the use of electric power in a mine at Ogden, New Jersey:

"Why just consider for a moment," he said. "If I were to put in steam engines, shafting, pulleys, and all the adjuncts of the ordinary mill power equipment, it would cost $300,000. With but two large high efficiency engines, dynamos and motors I can obtain the same result at a fraction of the cost . . . Just think of the opportunities the great New England milling districts offer to the electrical engineer. All along the rivers you find thousands of horsepower going to waste over falls and dams that could be utilized to run motors and operate mills."

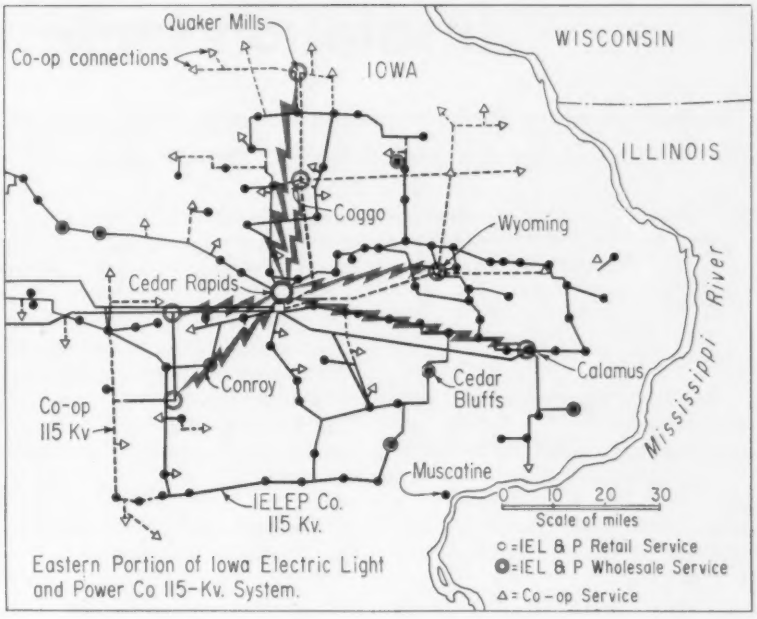
. . . and Develops an Electrified Plant

He referred also to one of his company's plants which he had already electrified:

"Every piece of machinery and every inch of shafting in that establishment is operated by motors at an immense economy. Look at the old practice. They had several small boilers and engine plants scattered about the different buildings. With the very best operation they realized only about one horsepower from six pounds of coal. With the new engine we get the same power from two pounds, and besides that, confine the necessary engines and boilers to a small house."

In the simple machine of William Wallace, Edison was able to envision an industrial world in which transmitted electric power would do the heavy work. Not only was he able to envision it, but even to electrify a plant to show that his idea was workable.

This was his genius. To take a scientific curiosity which someone had uncovered, and put it to work for man. He had the foresight, and the energy to turn his foresight into reality.



RADIO SYSTEM is shown in its relationship to the eastern portion of Iowa EL&P's system, branching out from Cedar Rapids to substations

Radio Speeds Trouble Reports

Ties major unattended substations to Iowa EL&P control center at Cedar Rapids; print-out alarm spots trouble

JAMES W. YOUNG, System Load Dispatcher, Operating Department, Iowa Electric Light & Power Co, Cedar Rapids, Iowa

Indications of trouble at major unattended substations on the Iowa Electric Light & Power Co system are radioed immediately by a remote alarm indicator system to the system control center at Cedar Rapids. A print-out of the alarm at the center pinpoints the substation.

Although the alarm system now includes six major substations, load growth will put it to maximum use on IEL&P's system. During a recent storm, an alarm was received at the control center, and an employee went in less than 3 min to investigate the trouble.

The remote alarm system was recently installed by the company. Previously, IEL&P used an alarm provided by local telephone companies through their switchboard operators, who connected the alarm to the home of IEL&P employees in the trouble area. This alarm system became obsolete when the telephone companies switched to dial operation.

The remote alarm system has a number of sender units at strategic points along the network to originate alarms. A decoder-printer at the centrally located system control center receives and records the coding via a radio receiver. The print-out code indicates the trouble location. Any alarm from strategic points is investigated.

This system may have as many as 290 sender units, each having an individual digit-tone number. Thus, the new remote alarm system allows many more strategic points to be added and all information to be gathered centrally.

In a substation outage or emergency, a contact closes to initiate operation of the sender. FM tone signals, representing the individual sender unit, are automatically transmitted to the system control center alarm receiver. The audio output of the radio receiver is fed continually to the digital decoder, where these tone signals are decoded into the specific number of the sending unit. The printer records this number on a visual tape and actuates a visual alarm light and an external alarm.

The remote alarm system is adaptable to any standard carrier or dual squelch, private line, VHF, two-way radio system. It has a "security tone" feature that effectively prevents false operation. The decoder-printer operates only when a valid tone is received. The alarm is repeated once a minute for 5 min for positive assurance of reception. It is transmitted via a directional antenna for maximum reliability.

The audio tone coders and decoders are of the "vibrasender-vibrasponder" type tone devices. These precision frequency devices require no adjustment and have proved their performance over ten years.

The alarm sender unit is completely self-contained and can be purchased in an all-weather chassis. On the IEL&P system, they are the indoor type. During standby time, only the heater oven for the crystal assembly remains on to insure precise on-frequency operation. The digital decoder unit is totally transistorized. The printer is a solenoid-operated device resembling a conventional adding machine.

Insulation Improvements Boost

Thermal uprating enables utilities to carry higher loads, thus extending service period before changeout or relief

W. M. RODGERS, Product Planning Engineer, and **J. H. CARPENTER**, Advance Product Engineer, General Electric Co, Rome, Ga.

J. A. SMITH, Power Distribution Engineer, General Electric Co, Schenectady, N. Y.

Recent improvements in the thermal capabilities of cellulosic materials, coupled with earlier advances in conductor insulation, have been applied in new transformer insulation systems whose higher capabilities bear directly on utility substation practices.

Cellulosic insulation deteriorates in use at a rate dependent on temperature, initial dryness of the insulation, and the rate at which products of decomposition are allowed to escape. It is very difficult to trace any positive percentage of transformer failures directly to insulation breakdown from the combined effects of temperature and time because:

1. The statistical sampling of failures is small, particularly those with data allowing evaluation of prior thermal history.

2. Damage initiated by internal winding failures frequently destroys significant evidence.

3. Even when winding failures are isolated with little physical damage by high-speed relaying, it is usually extremely difficult to prove that temperature and time contributed directly to the failures.

4. The possibility of such random causes as foreign material or physical damage during manufacture, shipment and installation can rarely be ruled out.

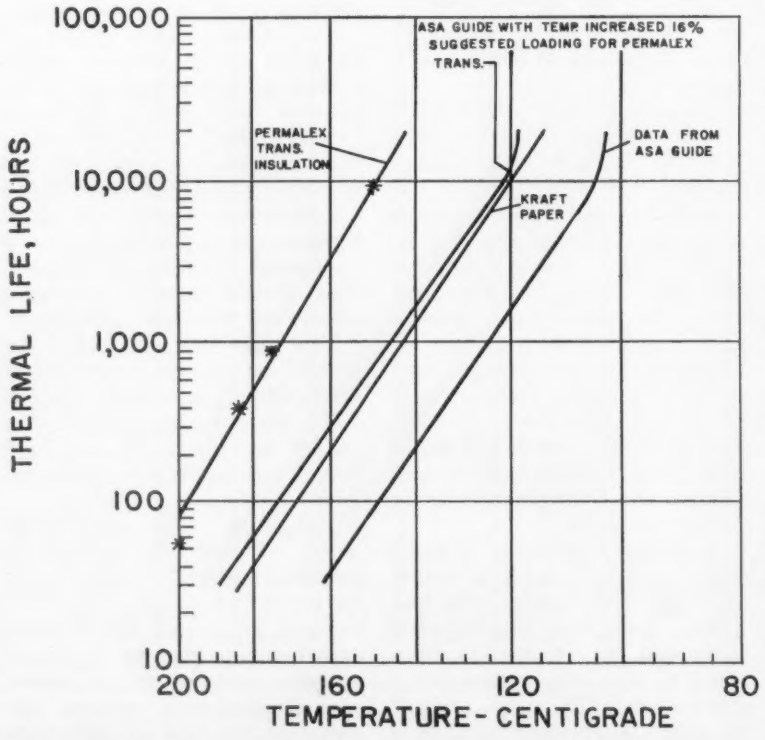


FIG. 1—INSULATION LIFE, plotted against temperature on special graph, shows greater tolerance of upgraded materials, justifies proposed temperature guide 16% above values in ASA loading guide

While the relationship between transformer failures and thermal history may be uncertain, the correlation between insulation strength of conventional materials and the loading of a given transformer is relatively specific. Laboratory tests of materials and life tests of transformers provide data which can be correlated with actual operating conditions.

Such tests show that the new, thermally upgraded insulation systems can withstand significantly higher temperatures than conventional insulations. The degree of upgrading can be evaluated by comparing accelerated life tests on the new insulation with similar tests on conventional material, as in Fig 1.

Experience Factor Needed

Accelerated life tests may not exactly duplicate the transformer insulation system, nor do high-temperature short-time tests exactly simulate transformer loading. Accordingly; an experience factor must be applied to the experimental data. Assuming that the temperature-time spread between the kraft paper curve and ASA Guide data defines such an experience factor, then the dashed "proposed guide for Permalex" curve would apply a similar experience factor. This proposed guide for upgraded transformers has temperature 16% above that of the existing guide for the same life expectancy.

The increased thermal capability can be applied to boost both normal and emergency ratings of substation transformers. The additional 10C average winding rise permits a 12% boost in normal loading over that for 55C insulation.

Daily peak and emergency (moderate loss of life) ratings can be computed for uprated transformers by applying the present ASA Guide to the 65C normal rating. This will result in maximum hottest-spot temperatures of 175C as compared to the 150C of the ASA guide. In such service, top oil could reach 110C, which is above the guide's 100C but well within the operating range of good transformer oil. Thus ASA Fig 92-02.110, showing loss of life vs hottest-spot temperature, can be

Substation Transformer Ratings

modified by boosting temperatures 16% as in Fig 2 to take full advantage of the capability of upgraded transformers. This chart can be used whenever the transformer hottest-spot temperature is known or can be calculated.

As loading usually is not on a precise basis, many users prefer the simplified method of kva multiplying factors tabulated in the ASA guide. These tables give the time-temperature-loss-of-life relationship for transformers with "average" characteristics. The method can be used for uprated transformers by applying the guide's factors to the 65C nameplate kva.

The full benefits of these new transformers is realized only when they are integrated into utility systems on the basis of their higher capabilities. Both normal and emergency ratings are higher by at least 12% than those of 55C transformers. In some cases, this will permit the installation of smaller transformers to carry a given load. In other cases, the extra 12% of normal capability at 65C will provide capacity for additional load growth before changeout or additional units become necessary. Either way, the additional capability of thermally-uprated transformers offers opportunity for significant savings when this capability is fully utilized.

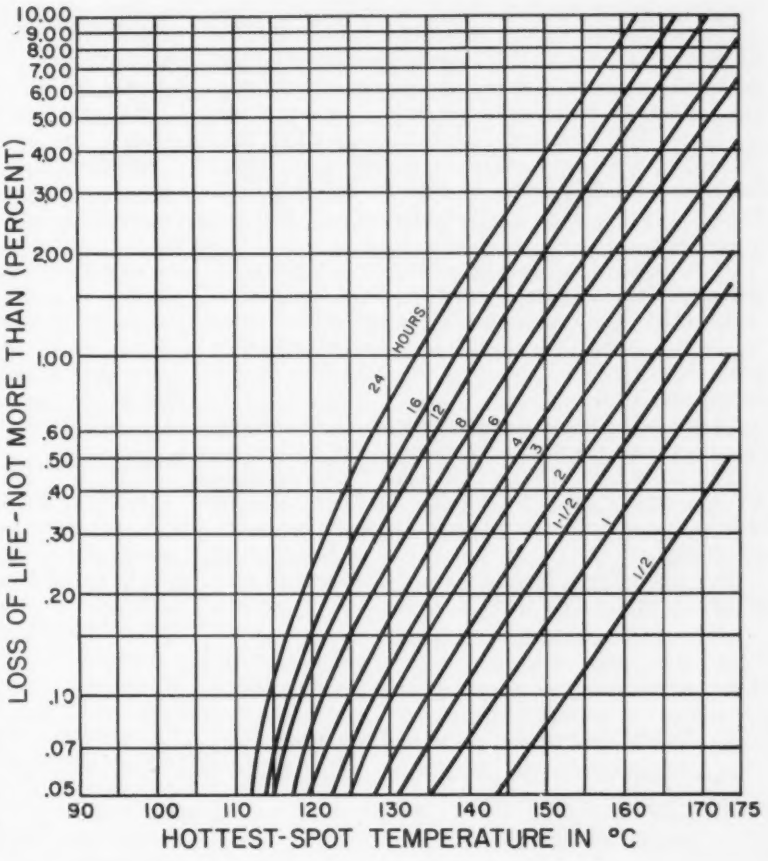


FIG. 2—**LOSS OF LIFE** vs hottest-spot temperature curves of ASA guide are modified by 16% boost in temperatures to reflect use of thermally upgraded insulating materials in transformers

55/65 Banks Save in Utility Subs

Deferment of investment to serve growing load is major benefit, subject to minimal dilution by increased losses during deferment period and by continuing inflation

KEITH W. AMISH, Planning Engineer, Rochester Gas & Electric Corp, Rochester, N. Y.

PAUL KARTLUKE, Application Engineer, General Electric Co, Syracuse, N.Y.

Evaluation of the added loadability of a 55/65C transformer in a utility substation hinges on its ability to carry 12% more load before relief. In a typical distribution substation, this ability can defer the installation of a second transformer for several years. Present worth of the carrying charges thus deferred measures the savings contributed by the uprated transformer. And the additional capital investment justified by these savings may be considered the value added to equipment being installed today, even though its additional loadability cannot be utilized immediately.

Consider a 3,750-kva transformer installed in a new substation and initially loaded to 50% of capacity. Assuming load growth at 6.5% per year, the transformer's load will reach 3,750 kva in 11 years. If this were a standard transformer, a second 3,750-kva unit would be installed in the substation at that time. But a 55/65C transformer with 12% additional capacity would suffice until the 13th year. Accordingly the 55/65C transformer should be credited with deferring the second transformer for two years.

Fixed charges at 15% on a 3,750-kva transformer with an installed cost of $18,000 are $2,700 per year. Assuming a 6% interest rate, the present worth of such fixed charges incurred 11 years hence is $2,000 x

0.5267 = $1,422. Similarly, the present worth of $2,700 fixed charges incurred 12 years hence is $2,700 x 0.4969 = $1,342. Savings in fixed charges due to deferment of the second transformer for these two years thus has a present worth of $1,422 + $1,342 = $2,764.

The additional capital investment which can be justified today for a 55/65C transformer is that investment whose annual fixed charges over the 33-year write-off life of the transformer have a present worth of $2,764. These additional fixed charges are $27,764/14.2302 = $194 per year. Hence the additional capital investment which can be justified is $194/0.15 = $1,293, or 8.6% of the purchase price of the 3,750-kva transformer.

In many cases such other substation equipment as structure additions, primary breakers, fuses, and disconnect switches, and transformer secondary breakers must be installed at the same time as the second transformer bank. Credit could be claimed for deferment of this investment, also.

On the other hand, if the current carrying capacity of such equipment is exactly equal to the 55C transformer rating, no credit can be given the transformer for its increased 65C rating unless the higher-capacity ratings of such other equipment are included in the evaluation.

This method may require a specific analysis of each proposed application. But it gives a more realistic evaluation of the 12% additional capability than the simple comparison of transformer purchase price per kva. Using this simplified comparison, the 3,750-kva transformer at $15,000 costs $4.00 per kva of 55C capability. Uprating it to 65C boosts its rating 12% to 4,200 kva for an average of $3.58 per kva. Crediting either the savings in dollars per kva or the 450-kva increase at $4.00 per kva indicates an evaluation of $1,800, considerably more than its value in the preceding case.

Inflation reduces the economic attractiveness of deferring investments, as savings in fixed charges during the deferment period will be offset to some degree by the increased cost of equipment in later years. Assuming an inflation factor of 1% per year, considered fairly representative for substation transformers of a specific rating, the installed cost of a second 3,750-kva transformer in 11 years would be $20,081 instead of $18,000, and the total present worth of savings in fixed charges due to deferment of this investment for two years would appear to be $3,083.

Inflation Affects Second Purchase

However, because of further inflation before the second transformer is purchased in the 13th year, this transformer will cost $403 more than it would have cost in the 11th year. Fixed charges on this additional $403 investment would cut the present worth of savings in fixed charges to $2,683.

Hence the additional capital investment which can be justified for a 55/65C transformer is $1,260, or 8.4% of the purchase price of the transformer.

Transformer losses are identical for each plan except during the 11th and 12th years. In the case of the standard 55C transformer, there would be two transformers in the substation during these two years. Hence, total losses would include core losses for two transformers and copper losses for each transformer decreased to about one-quarter of the full-load value because each transformer would be operating at about half-load.

With the 55/65C transformer, on the other hand, there would be only one transformer in the substation during the 11th and 12th years. In this case, there would be core losses for only one transformer but copper losses would be much greater because the single transformer would be operating at slightly over full load.

Assuming $40 per kw per year for demand, $0.004 per kw per hr for energy, a 25% loss factor, core loss of 7 kw and full-load copper loss of 25 kw for each transformer, the total cost of losses is calculating to be $3,489 for two standard 55C transformers and $3,812 for one 55/65C transformer during the two-year period. The $323 difference can be converted to a reduction of $169 in the present worth of savings and a reduction of $83 in the additional capital investment which can be justified for a 55/65C transformer.

The method outlined demonstrates satisfactorily the value of thermally upgraded transformers for substation use. The data are typical, and similar data from other systems would cause only small changes in the result. For complete accuracy, however, each transformer should be evaluated with data from the system on which it is to be installed.

Table I—Present Worth Formulas

Present worth of a $1.00 investment to be made M years from now, based on interest rate i:

$$PW_M = \frac{1}{(1+i)^M}$$

Present worth of a uniform series of $1.00 investments made each year for N years, based on interest rate i:

$$PW_{0-N} = \frac{1}{i}\left[1 - \frac{1}{(1+i)^N}\right]$$

Present worth of a uniform series of $1.00 investments made each year for N years starting M years from now:

$$PW_{M-N} = PW_M \cdot PW_{0-N}$$

NOTE: Values of PW_M and PW_{0-N} may be found in mathematical tables.

Table II—Evaluation Data

3,750-kva, 34.4-4.36-kv, 3-phase transformer:

Price	= $15,000.
Installation Cost	= $ 3,000.
Core Loss	= 7 kw
Full Load Copper Loss	= 25 kw
Load Growth Rate	= 6.5%/yr
Fixed Charge Rate	= 15%/yr
Interest Rate	= 6%/yr
Transformer Write-off Life	= 33 yr
Inflation Factor	= 1%/yr
Demand Charge	= $40/kw/yr
Energy Charge	= $0.004/kwhr
Loss Factor (% equiv., hr. at full load	= 25%

Says US Can Save $137 Million

Boulder RMEL meeting hears use of utilities' transmission would also yield income tax revenue on storage power

Transmission of Colorado River Storage Project power over the combined facilities proposed by investor-owned utilities would save the federal government $137 million in investment costs, the Rocky Mountain Electrical League was told at its spring conference at Boulder, Colo.

Furthermore, the government would collect more than $96 million in income taxes, said L. R. Patterson, Public Service Co of Colorado. Describing the proposed system, he said that its proper use would prevent wasteful duplication of circuits. Patterson emphasized that benefits from the use of the combined system would not cost the area consumer more, preference rights to federal power being fully protected.

The main-shaft-driven boiler feed pump promotes the automation of the modern steam plant, declared I. J. Karassik, Worthington Corp. Ten utilities, he said, have ordered these pumps, a total of 29 units, for installation in 17 stations.

Sees Pump Changes

Karassik predicted that BF pumps will be equipped with monitoring instruments for condensate injection sealing control, and with warm-up provisions and protection against excessive vibration. He said that BF pumps will soon be built, tested, and permanently welded into the feed-water circuit, and that inspection and overhaul will not involve dismantling.

Capacitors for power factor correction can also regulate voltage at very small added cost, R. E. Reinbold, Arizona Public Service Co, told the conference. His company, he said, has used such voltage regulation over the past six years.

Arizona PS, he said, started installing capacitors for economic power factor correction in 1953. Discovering their use for voltage regulation, the company began to abandon regulators, until today the 72 12-kv feeders in Phoenix metropolitan area and feeders elsewhere in the state operate without them.

The change to capacitors, he said, resulted in the simplification and in the reduction in size and cost of substations, as well as in improved customer voltage. The last effect he ascribed to a reduction in voltage spread between a customer near the substation and the last one on a feeder.

As rack, switch, fused disconnect, and control equipment costs are constant, regardless of bank size, the largest practical size—1,200 kvar—of capacitor bank should be used, Reinbold continued. He added that simple voltage-sensitive control is satisfactory for the last half of a feeder, voltage drop being sufficient to operate it.

Speeds Load Transfer

But the first half of the feeder, he said, usually needs current-compensated voltage-sensitive controls. Present trends to larger feeder conductors having higher X/R ratio and increasing low power factor loads, he said, further favor switched capacitors for obtaining voltage regulation.

Public Service Co of Colorado now guarantees load transfer in less than nine cycles at an airfield spot network near Denver, said W. M. Winslow and R. K. McCaig. This was done, they said, by installing wire wound balancing transformers between transformer banks and protectors and by revamping the network protector relay system. Primary radial feeders of different length and characteristics complicated the problem.

Cites Outage Effects

A nine-cycle outage, they said, would have shut down two computers for processing information on flight reservations for United Airline's system, and accumulated heat would have delayed restarting them for a half hour.

Balancing transformers, they pointed out, prevent power-flow reversal from large phase-angle differences between supply feeders during all except light-load periods. The method used for connecting the balancing transformers causes their magnetizing currents to become a circulating current which subtracts vectorially from the in-phase components.

The value of phasing volts for opening a protector is not constant, varying with customer load and power factor, they continued. Hence the reclosing functions of the relays cannot be used because they do not sense the complete limits within which the balancing transformers keep the protector closed.

Only a very complicated current-voltage sensing control can coordinate the network-protector reclosing operation fully with the full capabilities of the balancing transformer, they said. As excessive phase-angle voltage for opening a protector occurs infrequently and briefly, the company decided to reclose the protector on a lapsed-time basis. Thus a new reclosing control was designed, built, and installed on each protector. The existing reclose function of the master relay was disconnected, and the phasing relay removed. The tripping or opening function of the master relay remained unchanged.

Reports Experience

McCaig said that the installation operates as a network as long as phase-angle voltages due to feeder loading do not exceed the capabilities of the balancing transformers, or a protector is not tripped by a feeder fault or an open line. Once opened, the installation operates as an automatic transfer mechanism and then automatically resumes network operation.

The 28-v relays and energizing the timing clock from the protector's transformer side prevent reclosure on a dead or open feeder, McCaig said, noting that there has been only one operation of the network protectors produced by excessive phase-angle voltage difference. The latter occurred when the feeder was loaded abnormally to simulate an emergency condition.

In five other operations, the reclose control successfully reclosed the protector after the desired time, said McCaig.

Dynamic Distribution Sketched

Computer evaluation of distribution system includes element of time for load growth and present-worth economics

Load growth and changing load, elements which make planning of distribution systems formidable, are incorporated into a "dynamic program" for evaluation by digital computer. This program, discussed by M. W. Gangel and R. C. Enger, General Electric Co, at the recent annual engineering conference of the Missouri Valley Electric Assn, Kansas City, includes new concepts and approaches to realistic system representation. The element of time with associated load growth and present worth economics is inserted into the program. (See illustration.)

Basic relation of factors of load, loss, and responsibility to the diversified demand curve for customer load is established. Variation in peak load power factor, expressed as a function of the size of customer group, recognizes different diversities between real and reactive power components, said the authors.

The program considers capacitors (secondary shunt or primary series) as a basic design tool. A method to represent the effect on loss factor of variable kvar flow from capacitor additions is included. The secondary system dynamic program covers a wide scope, the authors stated. The program permits secondary system cutting with procedures and multipliers to represent actual physical changes.

For transformer loading, the program uses upper and lower limits to cover the range of permissible initial load levels available to the designer. Also, values of ultimate load different from that first established by the designer may be analyzed in subsequent runs. Simplified determination of theoretical transformer life is adapted for the secondary system planning program.

Primary Loop System Chosen

Primary loop systems using direct-buried cable and pad-mounted transformers have been selected by Union Electric Co to serve four new residential subdivisions and three apartment developments. Each system, said W. K. Smith, will be connected at each primary cable end to an overhead supply through a fused disconnect switch at terminal poles.

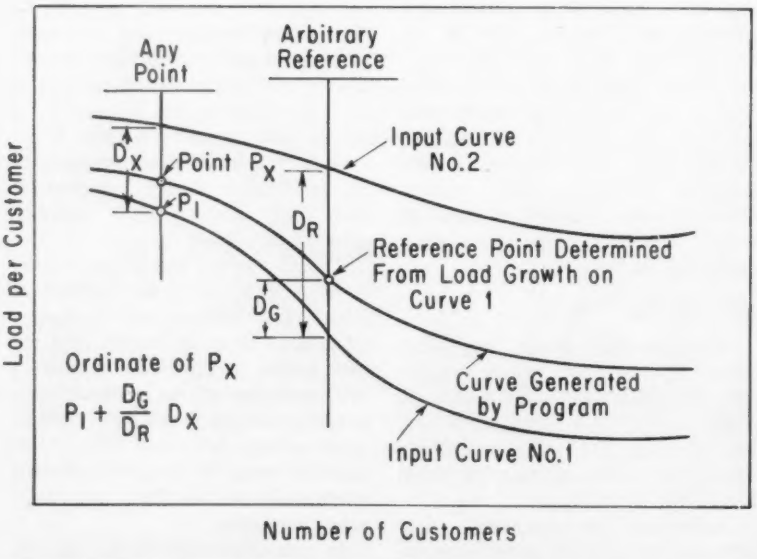
The cable is connected through disconnects to a bus at each pad-mounted transformer, with the transformer energized from the bus through a primary bayonet-type fuse. One disconnect is normally left open at the center transformer in the loop so that half the transformers are served from each end of the circuit under normal conditions. Transformers have secondary breakers to clear cable faults. Customers' secondary cables are tied directly to transformer terminals or to a secondary main in a handhole, depending on lot size.

An engineering standard covering economic conductor sizes is being used in designing primary distribution feeders at Union Electric, reported F. F. Gray. Analysis shows that only 1/0 ACSR, 336.4-MCM AA, and 556.5-MCM AA conductors (covered and bare) plus No. 4 ACSR (bare only) are needed to provide economic sizing for distribution loads considered. Economic sizing for spacer cable installations and 34-kv subtransmission circuits probably will be adopted soon, Gray said.

A system of special epoxy resin and Orlon tape can provide reliable, low-cost, pothead-less terminations for all the 15-kv indoor class, some of the 15-kv outdoor class terminations as well as pothead-type terminations in the 35-kv class. This is the experience of Baltimore Gas & Electric and Oklahoma Gas & Electric, reported Kris Neville, Epoxylite Corp.

Going further, Neville said overvoltage tests on 15-kv outdoor terminations without rainshields are in progress in an industrial area in Baltimore. After about one year of exposure at 50 kv (2.3 times rated voltage), no failures have occurred. OG&E has reported excellent success with 15-kv terminations using a rainshield; a rainshield installation is being investigated at Baltimore also. Concurrently, 15-kv terminations with a smooth overcoat of a special epoxy instead of a rainshield are on test.

(*Continued on page* 97)



CUSTOMER LOAD GROWTH is determined by interpolating between curves of diversified peak demand per customer. At least two curves are needed—one for an initial load condition and one for a higher load level in the future

In '61: One Million Electrically Heated Homes

Electric Heating Survey

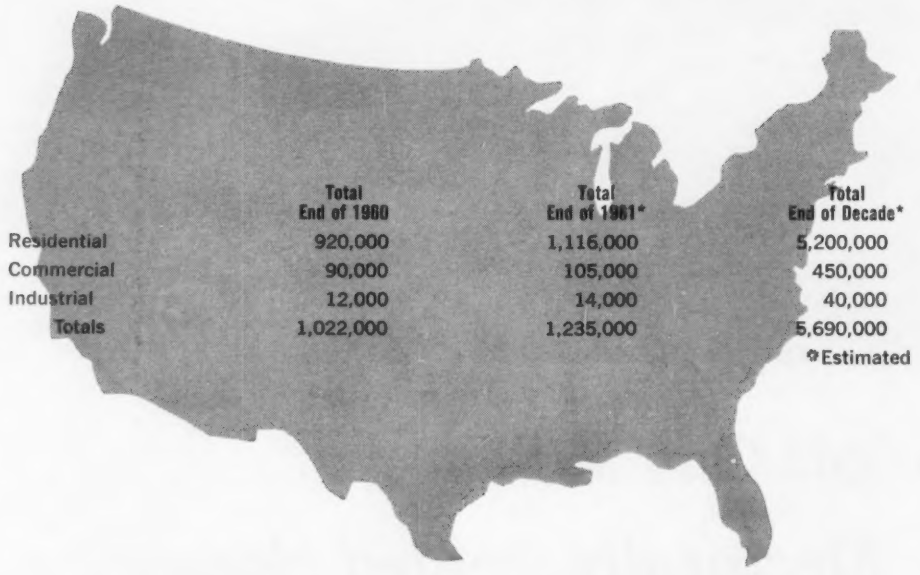
- Electric Heating Survey discloses there will be 1,116,000 electrically heated homes in the country by the end of 1961
- Utilities expect to have 5.2 million homes with electric heat by the end of the decade
- Heat pump expected to capture 26% of the residential market in 1970, a jump over the 11% of 1960
- Power companies begin to tap the conversion market. Though present status is 24% of all electrically heated homes, this will increase to 30% by 1970

John D. Damon
Commercial Editor

The Survey Covered:
134 utilities, out of 244, surveyed, or a 55% return
These 134 utilities represent 43 million meters or 74% of the total US meters
Breakdown of Utilities:
123 are investor-owned utilities
11 are large municipal systems or public power districts

Percentage of Conversion Market

Total Number of Electrically Heated Homes and Buildings



	Total End of 1960	Total End of 1961*	Total End of Decade*
Residential	920,000	1,116,000	5,200,000
Commercial	90,000	105,000	450,000
Industrial	12,000	14,000	40,000
Totals	1,022,000	1,235,000	5,690,000

*Estimated

Electric heating has reached a milestone. There are now one million electrically heated homes in the country.

This compares with 920,000 on utility lines at the end of 1960.

Both figures top previous estimates made by *Electrical World* and others.

If, as the saying goes, "The first million is the toughest," electric heating has a bright future. So bright in fact that EW predicts there will be at least 5.2 million electrically heated homes by the end of 1969.

Utilities are also beginning to tap the conversion market in electric heating.

The survey shows that there were 220,800 existing homes electrically heated at the end of 1960, or 24% of the total market. This is expected to increase to 279,000 existing homes by the end of this year, and jump to 1.56 million by the end of 1969.

This trend is in line with what many electrical men have been preaching for a long time—that utilities will have to go after the conversion market if they expect to reach electric heating goals set for the end of the decade.

Electrical World's survey shows that there will be 5,200,000 electrically heated homes on utility lines at the beginning of 1970. This figure does not quite reach the 6-8-million goals predicted by some in the industry, which shows that utilities will have to punch harder at the conversion market if they expect to reach the 8-million mark.

J. H. K. Shannahan, assistant vice president of American Electric Power Service Corp, said recently that conversion installations in old houses for AEP companies are increasing at a faster rate than new home installations. The rate of the former was up 60% in 1960. The company is hoping for 500,000 electrically heated homes in 1975. "This means we must shoot for the old-home heat-conversion market, since new-house construction is not expected to exceed 300,000 in our area," Shannahan said.

Conversion sales, however, are tough. Most older homes are not well insulated. Consequently, reinsulating is usually required and a careful check of houses must be made before installing electric heat. What utilities are doing about recommending adequate insulation will be found in a later section.

Another good reason for going after the conversion market is the fact that new-home starts are behind a year ago. The month of April was 7% behind that month a year ago. The first quarter as a whole was down 6% and no upturn is seen as yet.

Another big factor which will help the conversion market is a bill now pending in Washington which would up Federal Housing Administration loans for modernization and repair from a present $3,500 maximum over 3½ years to $10,000 spread over a 25-year period. This would aid a large portion of present homeowners to modernize and/or repair their homes and create a

to Increase to 30% by 1970

Here's The Equipment Breakdown

	1960			1961*			1970*		
	Resistance	Heat Pump	Total	Resistance	Heat Pump	Total	Resistance	Heat Pump	Total
Residential	818,800	101,200	920,000	959,760	156,240	1,116,000	3,848,000	1,352,000	5,200,000
Commercial	39,600	50,400	90,000	46,200	58,800	105,000	216,000	234,000	450,000
Industrial	8,640	3,360	12,000	10,360	3,640	14,000	30,800	9,200	40,000
Totals	867,040	154,960	1,022,000	1,016,320	218,680	1,235,000	4,094,800	1,595,200	5,690,000

*Estimated

ready market for electric installations.

In the new-home market the trend seems to be all-electric homes in big chunks. The largest is located in New Jersey. "Electric City, U.S.A.," now in the final construction stages, has 6,000 Gold Medallion Homes in the $12,990 to $24,000 price range, all with electric heating and cooling.

Other utilities are pushing for—and getting—all-electric areas.

As one electric heat man said, "If we're going to move in this electric heating business we will have to move fast and in big numbers."

More Homes Have Resistance

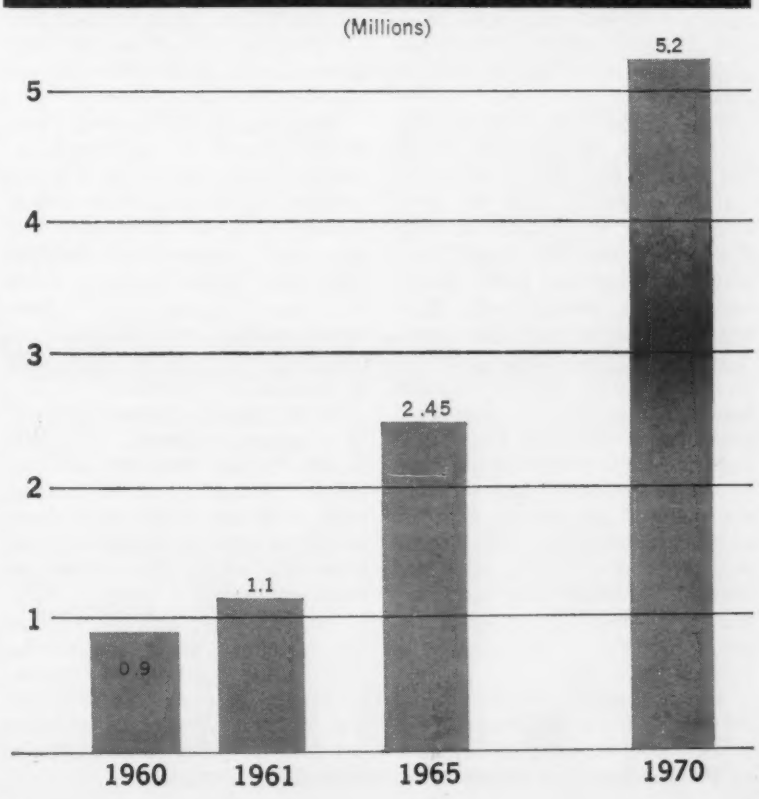
Of the 920,000 electrically heated homes on the lines at the end of 1960, 89% have resistance heating, while 11% have heat pumps. By 1970 this is expected to reach a figure of 74% resistance heated homes and 26% of homes with heat pumps. By consulting the chart above, one can see that heat pumps will continue to dominate in the commercial market through the end of the decade, while the industrial market will still favor resistance heating for plants.

Electrical World's survey covered 74% of the total US meters. This is an increase over the last survey of four million meters, and is one of the reasons for EW's present forecast topping both the 1959 survey, and its projected estimate of 1960 electrically heated homes.

Other reasons for this increase appear to be that final figures were in utility records when this survey was taken, and also utilities now seem to have better reporting methods for establishing the number of electrically heated homes on their lines than they did before.

Of the new homes in utility service areas, nationally, utilities estimate that 15% of the new homes went to electric heat in 1960. They further estimated that this will increase to 18% in 1961. Of course many utilities have figures way over the national average. For instance, AEP is averaging just over 30% in the installation of electric heat in all new housing starts. Of AEP companies, installations in new homes are running as high as 95% in Kingsport, Tenn. In some areas

Number of Electrically Heated Homes



New All Weather Comfort Standards

The New and Existing Market

		New		Existing	
Residential					
	1960	699,200	76%	220,800	24%
	1961	837,000*	75%	279,000*	25%
	1970	3,640,000*	70%	1,560,000*	30%
Commercial					
	1960	67,500	75%	22,500	25%
	1961	78,750*	75%	26,250*	25%
	1970	342,000*	76%	108,000*	24%
Industrial					
	1960	9,000	75%	3,000	25%
	1961	9,660*	69%	4,340*	31%
	1970	23,600*	59%	16,400*	41%

*Estimated

near Fort Wayne, Ind., it is nearly 70%.

In the East South Central region one utility had 98% of new homes going to electric heat in 1960, while another had 95%. In the Far West a utility had 70% in 1960 and expects 72% this year. One other utility had only 15% in 1960 but they expect this to leap to 40% in 1961.

Total connected electric heating load was reported by 109 utilities (see chart, p 61). Tabulation shows that these utilities have an 88% load in favor of resistance heating. The region with the greatest percentage of total load is the Pacific region, while second is the East South Central region.

What kinds of resistance equipment goes into the electrically heated homes in this country? Baseboard continues to dominate the market and is expected to increase this year. In 1959, baseboard had 44% of the market, and this is expected to increase to 55% in 1961. Second most popular is ceiling cable and though, like wall units and glass panels, it shows an expected decrease for 1961, it will still capture 23% of the market.

The item which has cut into this market is the electric furnace. Nationally it is reported to have 3% of the market. Our survey shows it to have 3.1% with predominance in the West North Central, South Atlantic and East North Central regions.

These then are the totals for installations already in. But how do utilities feel about electric heating equipment; what kinds do they lean to? Forty-six percent said they prefer baseboard, while 17% lean towards ceiling cable.

Those who prefer baseboard said they do because it is easy to install, and has a neat appearance. It also seems to be the preference of their customers. Some utility men also mentioned "better heat distribution," and "better comfort." Those who like ceiling cable feel it gives even heat, has a low installation cost and does not affect the room decor or furniture arrangement.

We've seen what customers prefer in resistance equipment. Now look at the buying decisions for heat pumps. According to the survey, 94% of the heat pump installations in the country are central systems, while 6% of the installations are room-size units.

On the commercial side, 47% of the commercial heat pump installations on the utility lines at the end of last year were custom-made central systems. Packaged units accounted for 29% and room-size units, 24%.

Industrial units were split up into 23% custom-made systems, 75% packaged units, and 2% room-size units.

As mentioned earlier, insulation is one of the most important requirements in a properly constructed home having electric heating. One hundred and twenty-four utilities make insulation recommendations while 63 make insulation requirements. Both are considerable increases over the 1959 survey when 101 utilities made recommendations and 40 made requirements.

Since that last survey a new set of standards has been developed for insulation—the All Weather Comfort Standards. These standards were developed "to assure a high level of comfort and economy for American homeowners, with the benefits of electric heating and air conditioning."

The purpose of the standards is to establish recommendations as to the extent electrically heated and air-conditioned homes should be insulated in terms of performance, and to establish responsibility for insulation product performance and proper installation.

Minimums under these standards are stated as "R" numbers. Accepted minimums are 19 in the ceilings, 11 in the walls and 13 in the floors over vented crawl spaces.

In this way, insulation people say, the homeowner with electric heat will benefit from lower first cost, lower operating cost, and greater comfort.

Of 120 utilities who follow the All Weather Comfort Standards, 72.5% use the minimums, while 27.5% use either a greater or lesser number.

There are still insu'ation problems, however, according to utility heating people. The greatest problems seem to be a disregard of the vapor barrier, poor application and installation of insulation, and inadequate insulation when an amount is installed.

The customer has to be sold on the importance of insulation according to many respondents. "The customer has a reluctance to install

Hope to Lick Insulation Problems

Total Connected Heating Load

(109 Utilities)

	Resistance	Heat Pump	Total
1. New England (10 utilities)	24,560 kw	1,412 kw	25,972 kw
2. Middle Atlantic (15 utilities)	116,060	6,433	122,493
3. East North Central (15 utilities)	379,581	33,201	412,782
4. West North Central (20 utilities)	77,716	14,862	92,578
5. South Atlantic (16 utilities)	466,265	180,578	646,843
6. East South Central (8 utilities)	1,103,329	108,777	1,212,106
7. West South Central (10 utilities)	128,675	86,686	215,361
8. Mountain (6 utilities)	15,980	13,444	29,424
9. Pacific (9 utilities)	1,611,015	66,547	1,677,562
Totals	3,923,181 kw	511,940 kw	4,435,121 kw

any adequate amount of insulation," one utility man fighting the insulation problem said.

The number of utility summer peaks continues to increase. On the last EW survey, out of 130 companies there were 49 with summer peaks and 81 with winter peaks. In this year's survey, however, of 132 companies, 61 now have summer peaks, while 71 have winter peaks.

Broken down by regions the peaking situation looks like this:

	Summer	Winter
New England	2	11
Middle Atlantic	9	9
East North Central	4	13
West North Central	14	7
South Atlantic	10	8
East South Central	3	6
West South Central	13	0
Mountain	2	7
Pacific	4	10

Certainly utilities didn't get the residential, commercial and industrial installations on their lines by just sitting back. Most of the utilities surveyed are aggressive promoters of electric heating.

Shown on the chart on p 60 is the fact that 106 companies, or 79%, promote whole house heating, of which 29 are combination companies. Of these 106, 104 promote supplemental heating as well, of which 30 are combination companies. Resistance heating is promoted by 107 utilities, of which 30 are combinations. Seventy six promote the heat pump. Of these, 17 are combination companies.

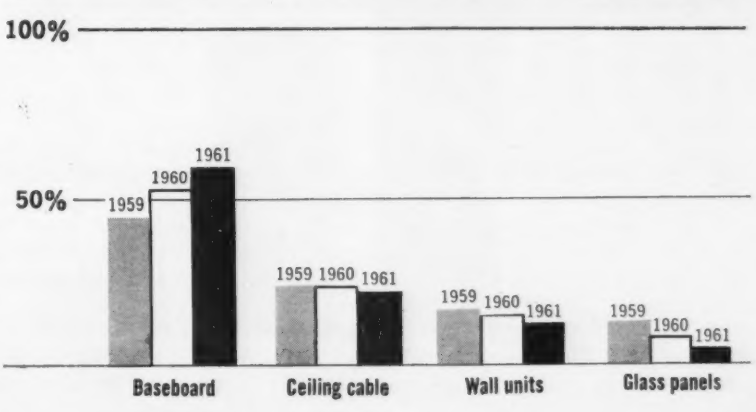
Of those utilities promoting resistance heating, 69 have been promoting for three years or less, while 25 have been promoting for more than three years, one as far back as 1946.

Heat pump promotion has taken a different tack. Forty companies have been promoting for three years or more, while 28 started promoting within the last three years.

Of those, 77 companies who have a budget billing plan for residential heating customers, the favorite method seems to be dividing the heating bill into ten or 11 equal payments, with bill adjustment made in the remaining period.

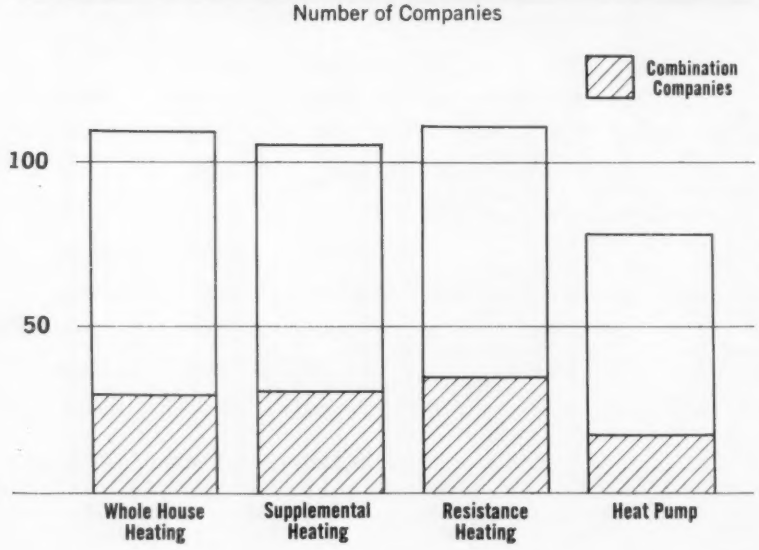
One utility man interested in selling electric heating said his major

Types of Equipment

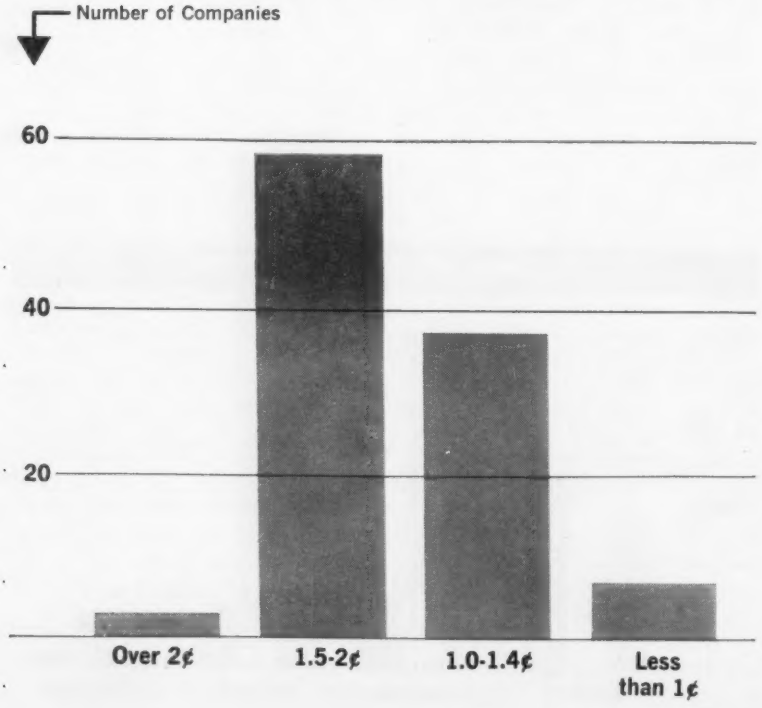


66 Utilities Have

Electric Heating Promotion



Electric Heating Rates



obstacle is "the resistance of builders, engineers and some in the electrical trade."

Most of the utilities have held educational meetings to explain electric heat to trade allies. The contractor was wooed by more utilities than any other trade group—98 of the utilities reporting they have held meetings for architects. Another 14 utilities plan to hold such meetings. Builders attended meetings at 94 of the utilities, while 13 more plan to hold a builder meeting.

Ninety-three utilities held meetings for dealers (13 more are planning meetings), while 74 held instructional meetings for architects with 20 utilities having a meeting in mind. Consulting engineers were invited to meetings by 73 utilities, and 15 more are planning such gatherings.

Who sells the bulk of the electric heating equipment? Sixty-one percent of the utilities say the electrical contractor sells the bulk of the electric heating equipment in their area. The dealer sells the bulk for 21% of the utilities, and the heating and ventilating contractor accounts for the bulk of sales at 18% of the utilities. Others mentioned were manufacturer representatives, distributors and the utility itself.

Fifty-seven utilities think the electrical contractor is "best qualified" to sell electric heating equipment; 28 think the heating and ventilating contractor, and 15 feel the dealer can do the best job.

Most of the utilities—70%—use the National Electrical Manufacturer Assn manual to calculate heat loss and estimated operating costs.

To get to the homeowner or home buyer interested in electric heat—utilities work through architects, engineers and various trade allies.

The percent of utilities who work with each are:

Architects	82%
Engineers	77%
Heating and Ventilating Contractors	77%
Electrical Contractors	23%
Builders	12%

Other groups utilities work with

Special Heating Rates

include distributors, the homeowner himself, bankers and real estate people.

Various promotional devices are used to get these groups interested in electric heat. Seventy-five percent of the utilities use personal calls, 47% use direct-mail pieces, and 25% employ specification sheets. Other important devices used are training and sales meetings. Also one active promoter said, "We take dealers or contractors to call on customers we have pre-sold."

Seventy-five percent of these utilities take leadership in trying to get these groups together.

More and more utilities are employing sales people to sell electric heating and heat pumps. Fifty-seven utilities have an average of 11 persons each devoting full time to selling electric heating and heat pumps, while 92 utilities have an average of 35 persons devoting part of their time to electric heating.

Here's The Promotional Backing

- INDIVIDUAL OR DEPARTMENT — 76% of the utilities have a specific individual or department assigned to supervise electric heating
- ELECTRIC HEATING POLICY—81% have a definite electric heating policy stating their position to guide customers, employees and the electric heating trade.
- DEVOTE FLOOR SPACE — 69% devote floor space in their stores and/or offices to displays of electric heating equipment
- BUDGET BILLING — 58% have a budget billing plan for residential customers
- LAYOUTS — 53% layout electric heating installations
- EMPLOYEES' PLAN — 39% have a plan for selling electric heating to employees
- HEATING AND COOLING SHOWS — 35% have held shows in their area

Utilities Have Employee Plan

Forty percent of the utilities have a plan for selling electric heating to employees. One of the first was instituted by Union Electric Co. The plan provides whereby any employee who installs electric heating as the "sole and complete heating for the entire house" may receive financial assistance in making the installation. For a heat pump installation the company makes a promotional allowance payment of $200 upon completion of the installation. For resistance heating equipment Union Electric pays $100.

Employees can also finance the installation under the company's Employee Purchase Plan.

Of prime importance in seeing that the customer gets the complete benefit out of electric heating are insulation and thermostat control. One hundred and twenty-eight utilities said they recommend a thermostat in each room. Most of them place no limit on the thermostat. However, 37 put a 5-kw limit, 12 have a 4-kw limit, and seven have one at 3 kw.

More and more utilities are installing special rates for electric heating, for they know that the ultimate cost to the consumer is one of the things which will sell more and more electric heating.

Forty-six percent of the surveyed utilities cited operating costs as their chief deterrent in selling electric heating.

Consequently, of 128 utilities, 66 have a special heating rate. This is a marked increase over the 1959 survey when 50 utilities reported special heating rates. In addition to the 66 utilities, 62 sell electric heating at the same rate as their end block residential rate.

A 1.5¢ rate is favored by 21 companies. The complete range is shown in the chart on p 62.

Of the promoting utilities most of them say they are competing against natural gas, No. 2 fuel oil, or LP gas. Of the 134 utilities, 103 compete effectively with gas, 89 compete against oil, and 99 are making headway against LP gas.

Eighty-one utilities reported advertising and sales promotion budgets of $55,371,764, or an average of $683,589 per company. Of this, an average of 18% per company was used to promote electric heating and heat pumps. Sixty-two companies said this was an increase over 1959, an average of a 42% increase for all utilities reporting.

Twenty-four utilities have figures on how much it cost them to add a kilowatt of electric heating and heat pump load in 1960. For 24 companies the average was $13.37/kw.

Of 55 utilities answering the question, 23 said their electric heating and heat pump earnings per kw were lower than other loads. Sixteen said they were higher, and the same number said, "about the same."

Extracted from the survey results were the top five investor-owned utilities and the top five public power utilities in terms of total electric heating installations. Although there are utilities in the country with greater growth rates for 1960, because of a small number of installations on the lines at the end of 1959, the top five investor-owned utilities all show a growth rate greater than 5% a year. All have a rate between 1.1 and 1.5¢. The utility with the

Top Five Investor-Owned Utilities

Utility	Ratio Peaks	Degree Days	How Long Promoting (years)	Heating Rate	No. of Electrically Heated Homes—1960	Growth Rate
A	.78	6500	DNP*	1.2¢	42,350	6%
B	.81	4632	One	1.1	33,979	13
C	1.08	4200	Six	1.28	33,311	17
D	1.00	2500	Six	1.4	18,984	27
E	.85	1574	Six	1.5	18,050	6

Electric Heat Is Superior Heat

largest number of installations has a 1.2¢ heating rate. Of the public power utilities one has a phenomenal 51% growth rate in spite of a high saturation. That utility promotes at a 9 mills rate.

Although the field has made tremendous strides in the past few years, utilities are still faced with obstacles in selling electric heating and heat pumps. As noted earlier, utilities are going to have to tap the conversion market if they expect to reach predicted goals in the installation of electric heating.

One utility executive said that his obstacle to selling is the installation cost on conversion installations. This indicates utilities who are going to go after this wide-open market will have to pay close attention to pre-selling the homeowner on the benefits of electric heat before presenting estimates.

To overcome the objections to electric heating, utilities use a variance of methods. Thirty percent sell the advantages and benefits electric heating has over other types of fuels. They say this can overcome most cost objections.

Many people say the best way to do this is to "use the user," i.e., take the heating customers on the lines who are "living better electrically" with electric heat and use their comments in advertising and direct mail pieces. This, one executive said, "will convince other home owners and home buyers that electric heat is superior heat—'comfort heat.'"

Top Five Public Power Utilities

Utility	Ratio Peaks	Degree Days	How Long Promoting (years)	Heating Rate	No. of Electrically Heated Homes—1960	Growth Rate
A	.56	3513	DNP*	.75¢	44,627	10%
B	.52	3384	Fourteen	.4	37,524	9
C	.50	3590	DNP*	.75	30,620	2
D	1.12	5275	DNP*	.9	12,159	51
E	.74	5000	Two	.62	6,159	14

*Does Not Promote

I'VE SEEN IT—YOU'LL LIKE THIS NEW LINE

General Electric's all-new line for electric comfort heating

"This complete line is tops in appearance, quality and easy installation. And when customers see that General Electric Monogram it sure helps close the sale," says Ollie Windhorst, owner, Reddy Electric Company, Inc., Louisville, Ky. Designed, engineered and manufactured by General Electric, the line includes:

THERMOSTATS—new beauty and compactness—blend with General Electric's popular decorator wall plates.

BASEBOARDS—new "square silhouette" styling. Linear thermal cut-out and General Electric Calrod® heating units are *standard equipment.*

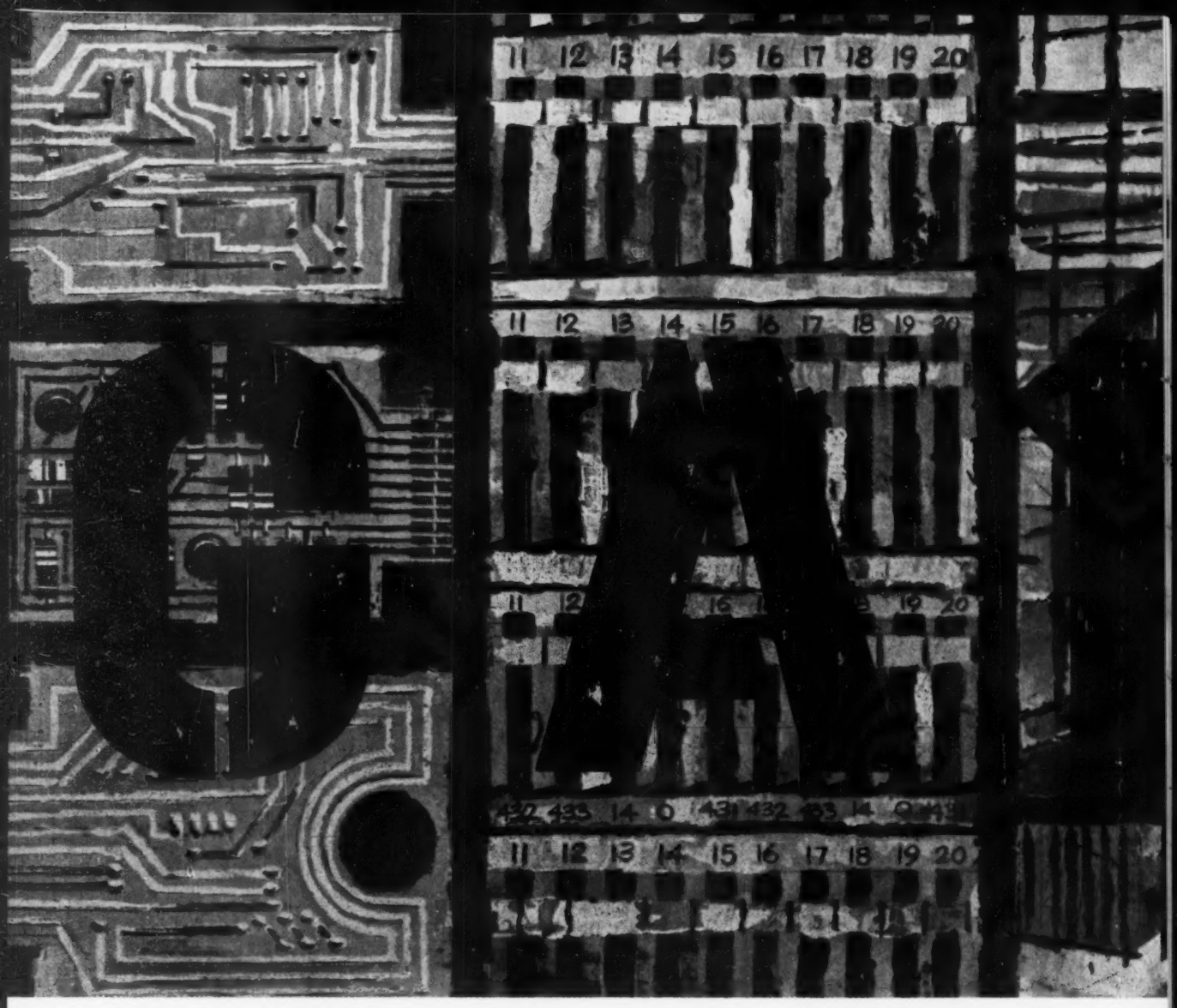
WALL HEATERS—new clean design, efficient performance! Thermostatic control, whisper-quiet, brushless fan motor.

RADIANT HEATING WIRE—new machine spliced, factory-sealed leads for positive connection. Sturdy metal spool dispenser.

FREE LITERATURE: *for complete details, write 49-112-5, General Electric Company, Electric Comfort Heating Section, Appliance Park, Louisville 1, Kentucky.* 280-01

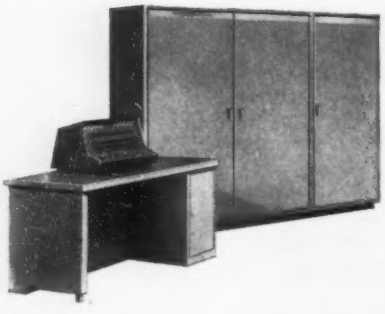
Progress Is Our Most Important Product

GENERAL ELECTRIC



G Gathers automatically the information the operator needs to supervise the plant.

A Alarms off-limit quantities... automatically warns when an unsafe value occurs and logs all points exceeding pre-set limits.



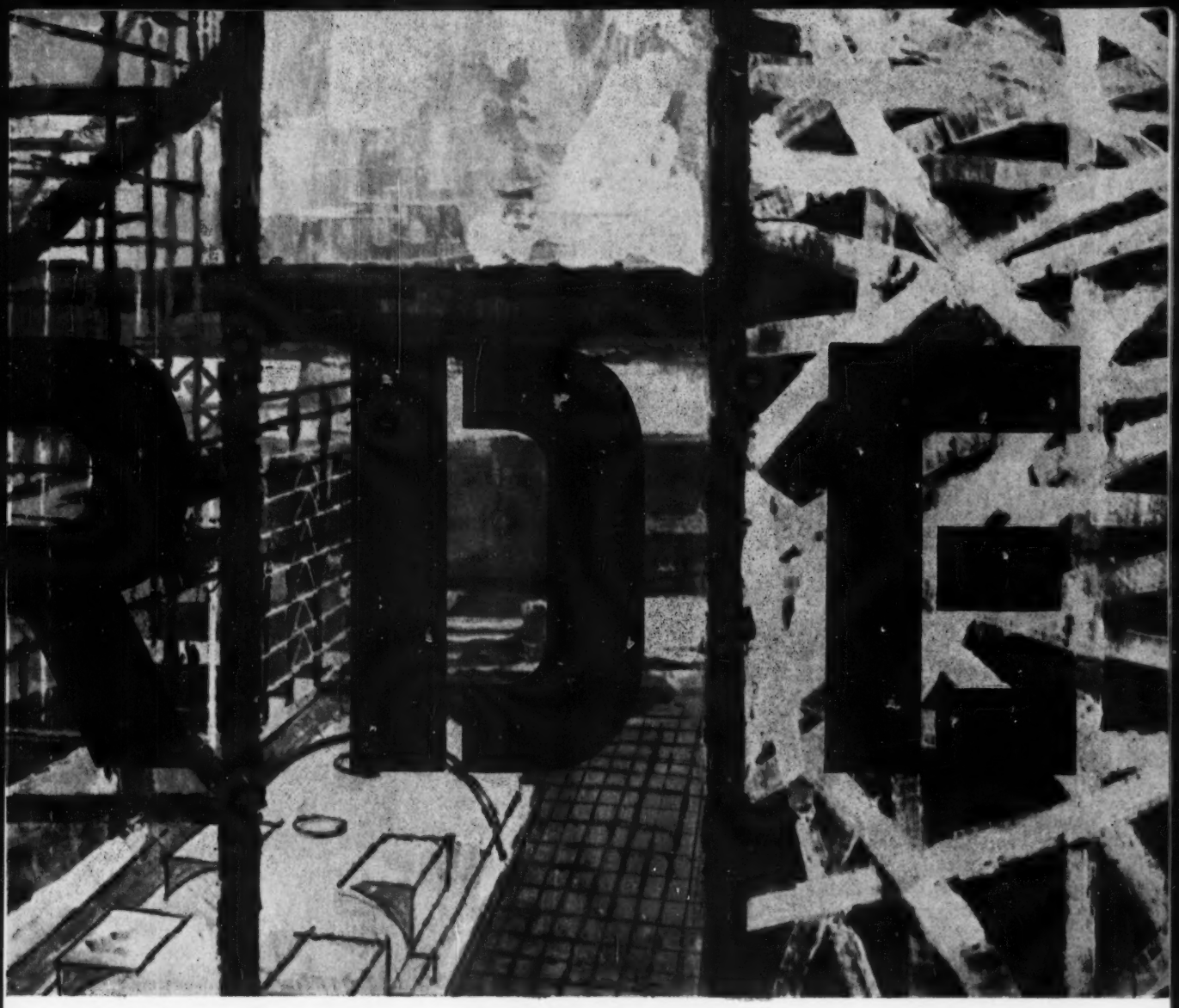
NEW GENERAL ELECTRIC COMPUTER SYSTEM

designed solely for electric utility steam power plant data processing

HERE'S HOW GENERAL ELECTRIC'S ADVANCED DESIGN SYSTEM LOWERS OPERATING AND MAINTENANCE COSTS...

GARDE is General Electric's process computer system designed especially to meet the problems and needs of electric steam plant data processing. The GARDE system gathers, alarms, reports, displays, and evaluates data from several

PCA-1



R Reports... automatically prepares a complete log of all operating conditions hourly or on demand.

D Displays... continuous visual display of any input or computed value that the operator chooses.

E Evaluates... over-all plant and key component performance hourly—or on demand.

hundred inputs located throughout the plant. It warns of abnormal deviations in those process conditions which cause equipment stress and inefficient operation. Early detection of these saves dollars in equipment maintenance and increases operating efficiency.

In addition, the GARDE system checks itself—detecting faulty sensors and other components. Its continuous reports are invaluable in periods of rapid operational changes. One of its provisions guides the operator through complex plant operating routines, helping him avoid errors and resultant equipment outage.

GARDE system evaluates these key plant operations: Boiler efficiency • Turbine Generator Heat Rate • Station Heat Rate • Correction of Heat Rates to Bogey Conditions • High Pressure and Intermediate Pressure Turbine Efficiency • Feedwater Heater and other Equipment Performance • Condenser Performance.

General Electric was able to design the GARDE system because it leads all manufacturers in process computer systems installed or ordered by the utility industry. The near-million man-hours of application and research in its design were spent in implementing systems for users. Out of this experience, came the GARDE process computer system.

Investigate this newest development in data processing for steam plants—contact your nearest General Electric Apparatus Sales Office or Process Computer Section, Industry Control Department, P. O. Box 2918, Phoenix, Arizona.

In Canada, contact Canadian General Electric Apparatus Sales Department, Peterborough, Ontario.

Outside the U.S. and Canada, contact International General Electric, 150 East 42nd Street, New York 17, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRIC UTILITY METHODS

E u m

OPERATIONS & TESTING

Potential Tester Checks High Voltages

E. L. HASENZAHL, Foreman-Operator, Power Transmission Stations, Baltimore Gas & Electric Co, Baltimore, Md.

By making use of an old principle, capacitive coupling, and adding amplification with transistors, batteries and a loudspeaker, a new tester for detecting "hot" lines and switches has been developed. The tester will produce an audible tone—rather than a visual indication—when the copper disk at one end is placed within the electrostatic field of a conductor. It is simple and rugged, needs no adjustment and is as safe as a switch stick.

The tester is composed of a chassis supporting a copper disk, a two-stage transistor amplifier, a triggering transistor, a transistor tone generator, batteries and a loudspeaker, all mounted within a 2½ x 8-in. tube of high dielectric strength. This tube is attached to a smaller tube that is slotted to fit over the head of a switch stick.

When the tester is in the electrostatic field of the conductor, a small current is induced in the copper disk and amplified in the common emitter two-stage amplifier. This ac signal is rectified by a diode and feeds into the base of the triggering transistor. As the triggering transistor conducts, it supplies half-wave dc to the emitter of the fourth transistor.

Connected in the base of the fourth transistor is a tone generator, an R-C network, which receives feedback from the output transformer for oscillation. The triggering transistor thus causes the tone generator to function and a tone is heard from the loudspeaker. This circuit makes it possible to differentiate between a 25 and 60-cps system. It also makes the output volume independent of the strength of the input signal.

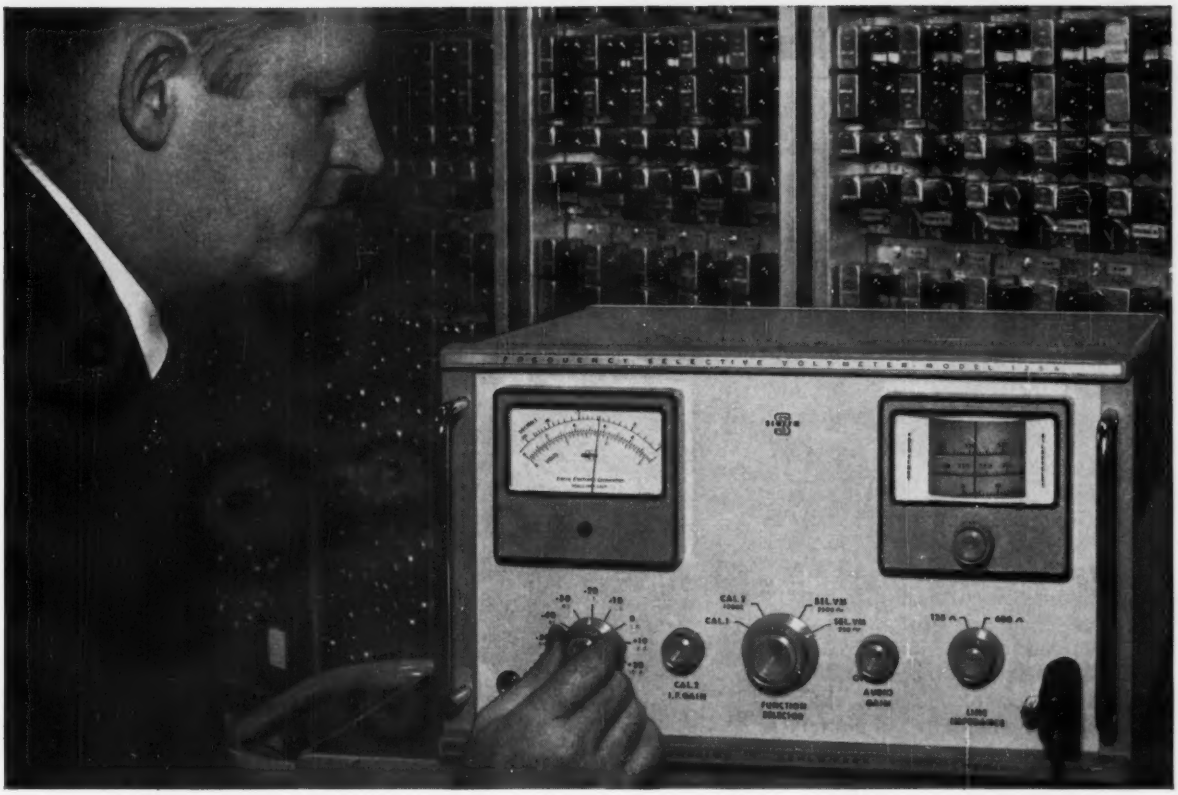
When the tester is placed on the switch stick, a built-in switch is closed, activating the tester. No further adjustment is required and no other connection is needed. Proper design in controlling sensitivity has eliminated interference from adjoining phases in indoor and outdoor structures where standard spacing has been maintained.

The device will produce its maximum volume when placed the following distances from a conductor: 4 kv, 1 in.; 13 kv, 4 in.; 26 kv, 12 in.; 33 kv, 18 in.; 110 kv, 3 ft; and 230 kv, 6 ft.

In determining the above values, all tests were made at grounding spades of ½-in. copper to eliminate the effect of current in the conductors. Insulated wire or cable can be tested easily but the distances will be greater than those above. Cables with metallic sheaths cannot be tested. The standard potential test procedure, live-dead-live, is used and demonstrates positively the tester's condition.

During field tests, the audible tester has performed very satisfactorily in the electrostatic fields of 60-cps voltages from 440 v to 230 kv. On 60-cps voltages below 440 v, the input disk must make contact with a live conductor to make the tester function. Even at low voltages a potential shock hazard has been eliminated because the device will function without being connected across a circuit.

Baltimore Gas & Electric Co previously has used three types of high-voltage test sticks, but they have been limited to circuits rated 34.5 kv and below. This limitation, in addition to excessive physical size and poor visual and audible indication, under some conditions led to the development of the present tester. A patent application for this tester has been filed by the author.



Why is the Sierra Frequency Selective Voltmeter the standard of the communications industry?

Performance-proved by thousands of users! • Accepted by all major carrier systems manufacturers, specified by most! • Uniquely convenient, versatile, dependable for monitoring carrier modulation level!

- Single frequency band, one continuous tuning range—eliminates band switching
- Flat voltmeter section—for accurate measurement, easy detection of spurious signals
- Wide bandwidth—1 to 620 kc—covers 120 channels per L carrier allocation
- Coarse, fine tuning on a single knob—for greater convenience
- Crystal controlled calibration oscillator—for checking both frequency and level
- Domestically produced—for years-ahead engineering, rugged construction
- Dual selectivity—versatility for communications test, wave analysis, general lab use

SPECIFICATIONS
MODEL 125A

Frequency Range
Tunable Mode: 3 kc to 620 kc
Flat Mode: 1 kc to 620 kc

Measurement Range
Tunable Mode: —90 dbm to +32 dbm
Flat Mode: —30 dbm to +32 dbm

Selectivity
Narrow: Down 3 db 125 cps off resonance; down 45 db 500 cps off resonance
Wide: Down 3 db 1.25 kc off resonance; down 45 db 5 kc off resonance

Price $895.00, f.o.b. factory

Call your Sierra representative or write direct. Sierra Model 125B-CR, with upper and lower sideband carrier re-insertion, and Model 125B-Y, with patchcord connections for type "O" and type "N" Western Electric carrier, also available at additional cost.

Data subject to change without notice.

sierra

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7127

Moloney Offers Metal-Clad Switchgear

Announcement of compact, metal-clad, magnetic-air switchgear in 5-kv and 15-kv ratings is made by Moloney Electric Co. This development will enable the company to offer not only the new switchgear but also transformers and switchgear coordinated for unit substations, J. J. Mullen Jr, president, told *Electrical World*.

The announcement follows news that 5-kv and 15-kv *production* units of metal-clad switchgear recently passed all tests at the KEMA Laboratories in Arnhem, Holland. Mullen added that production will begin immediately at newly-acquired facilities of Moloney's switchgear manufacturing division in St. Louis, with early fall delivery available. Heading up the new division is Donald E. Spackler, general manager. Carl E. Mercier is the chief design engineer (See News About People, p 92).

The new metal-clad switchgear, for both indoor and outdoor applications in all standard 5-kv and 15-kv breaker ratings, reflects the trend toward smaller, more compact units, Moloney reports. The new units have these dimensions: a 5-kv indoor unit measures 26 in. wide, 58 in. deep and 63 in. high; a 15-kv indoor unit is 36 in. wide, 85 in. deep and 75 in. high.

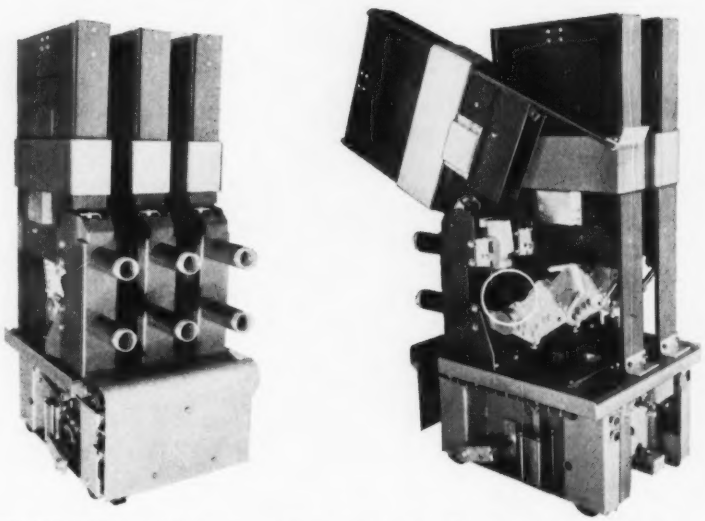
In addition, Moloney told *Electrical World,* the new switchgear embodies a number of design "firsts":

• Use of "blow-on" forces on *both* the main and arcing contacts to gain increased contact pressure upon closing. Electromagnetic blow-on is obtained on arcing contacts through design geometry. Blow-on on main contacts is derived from a slotted block between primary conductor and stationary contacts which directs current flow in a loop.

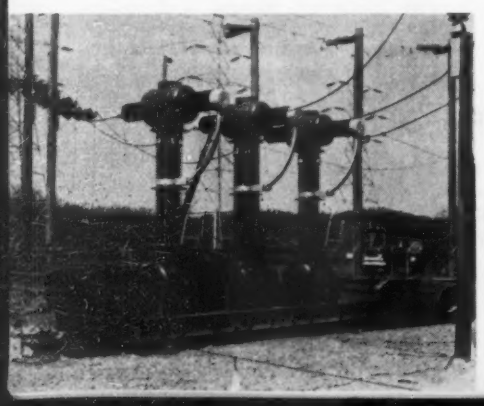
• Optimum cooling of main current-carrying components is provided by intercooling of hollow primary conductors. An orifice in the top of the conductor allows convection air cooling. The air puffer is placed inside the hollow conductor, with a glass polyester nozzle affixed to the end of the conductor. The stationary nozzle directs the air blast "directly at the heart of the arc."

• Proper arc interruption over the full fault current range is assured by face-wound blow-out coils, compound-wound in the shape of a block figure-eight. Moloney reports a more intense magnetic field is gained for low fault currents by additional turns at the bottom of the coil. Less turns at the top of the coil afford a low flux density to hold the arc in the interrupter until it is extinguished.

Other features of the switchgear include zircon arc-chute barriers for the interrupter assembly, stacked in their uncured state, then cured and fused in one process; encapsulated instrument transformers; breaker-mounted auxiliary controls requiring no separate testing controls; glass polyester insulation system (porcelain is used on 15-kv gear in critical dielectric locations); and duel breaker safety interlocks. In addition, production techniques are improved by extensive use of molded glass polyester components, preformed parts including bushings supports, current transformer castings, bus joints, and puffer nozzle.



PUFFER NOZZLE (circle) is affixed to the end of hollow primary conductor



ACR 'Stands Free' for 'Interrupt' Tests

A 138-kv General Electric air-blast breaker rested un-bolted on a flat bed truck while interrupting a 40,000-amp fault in less than two cycles at recent American Electric Power System field tests.

According to engineers conducting the tests, a comparable oil circuit breaker under the same test conditions would require a heavy concrete foundation and tie-down bolts to restrain the breaker during the resulting impact.

Field tests were held at the AEP

System's Philip Sporn Plant substation early in April with engineers from the AEP Service Corp, Appalachian Power Co and General Electric's high voltage switchgear department cooperating.

Included in the tests were single-phase, line-to-ground faults 3¾ miles down line from the breaker. These "short-line faults" produce electromagnetic waves traveling back and forth on the line with the speed of light, and result in high rates-of-rise of recovery voltage across the breaker.

To produce the highest rates-of-rise of recovery voltage possible, AEP engineers chose to fault the particular conductor having the highest surge impedance. GE engineers blocked open the other two poles to further increase the surge impedance and severity of the test.

The GE Type ATB air-blast breakers cleared all faults in less than two cycles. Considered to be the world's fastest operating transmission-type power circuit breakers, they recorded a maximum interrupting time of only 1.85 cycles for all tests. The fault currents interrupted were the highest ever recorded on 138-kv field tests.

Power interruption tests with fault currents ranging from 8,200 through 41,000 amp, including an ungrounded 3-phase fault directly on the bus, were conducted to prove the speed and reliability of the equipment.

Engineers inspecting the breakers, after completion of the test, said the series could be repeated without renewal of parts.

'Assembly' Developed for Pipe-Cable End Closure

The US Patent Office has granted a patent to Anaconda Wire and Cable Co for an end-closure for cable-enclosing pipes. The invention is for an end seal for pipe-type cables, that allows for the expansion and contraction of the cable.

Advantage of the device is that it does not require excessive pressure against the cable which might damage cable insulation. At the same time, the oil seal is not disrupted by cable movements. It is reported that the bellows-type device relieves

Now

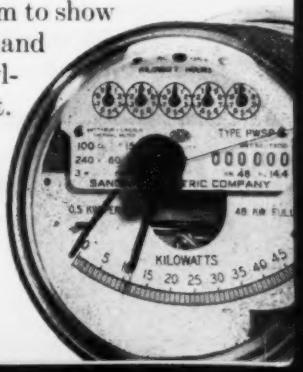
Sangamo Lincoln Combination Meters have TRUE MAGNETIC FLOTATION

New from Sangamo—singlephase and polyphase combination kwh/thermal kw demand meters with the moving system that *floats* on a magnetic field created by specially bonded Alnico magnets.

The singlephase J3T combines Sangamo's new J3 watthour meter and the Lincoln watt demand meter into a single unit. PW polyphase meters combine Sangamo's new P20 two stator watthour meters with two element Lincoln watt demand meters. The magnetic floating system further increases the established dependability of these combination thermal meters.

These new meters are compact and use conventional round covers. They retain the proven advantages of previous Lincoln demand meters: independent watt demand and watthour measurement, dual range, sectionalized construction, and interchangeability.

Your Sangamo Representative has the full story on both the J3T and PW meters. Ask him to show you these new developments in demand meters from Sangamo . . . the acknowledged leader in demand measurement.

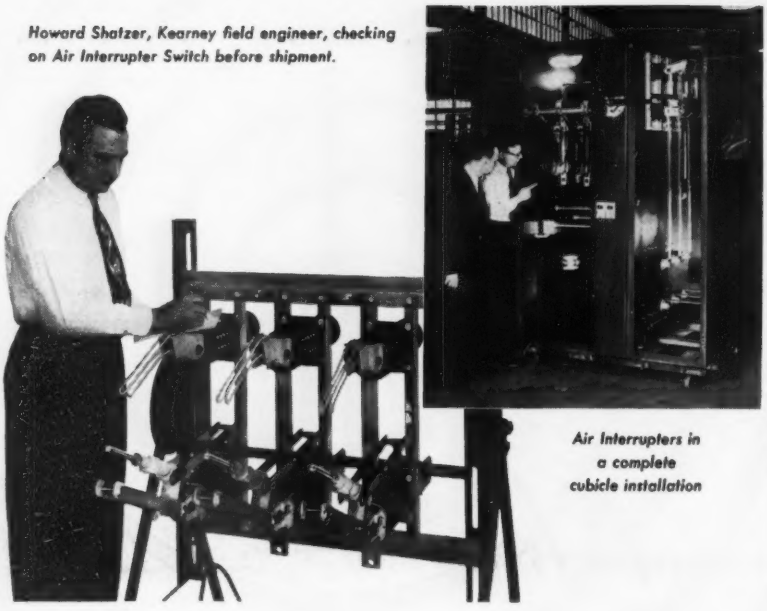


SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

PW61-6

Howard Shatzer, Kearney field engineer, checking on Air Interrupter Switch before shipment.



Air Interrupters in a complete cubicle installation

Specify KEARNEY...

for safe AUTO · SPEED interruption

in metal-enclosed switchgear

What is **Auto-speed interruption?** . . . An automatically produced interruption that always occurs at the same point in the switching operation, and always takes the same time (one-half cycle). Human error is eliminated from the switching action by a trigger spring mechanism which trips the switch at a pre-set point. Contacts are separated inside a dry type interrupter unit.

Specify safety for personnel and equipment. No exposed Arc. Kearney Air Interrupter Switches will not produce external arcing dangerous to men or equipment.

Specify economy. Costing less than circuit breakers and with interrupting capacity not found in air break disconnects, Kearney Air Interrupters are ideal for . . . interrupting magnetizing charging current of transformers . . . interrupting charging current of lines and busses . . . interrupting exciting current of feeder regulators . . . interrupting load currents to rated capacity . . . sectionalizing feeders and distribution circuits.

Specify Engineering Ability. Kearney's staff of engineers is experienced in adapting or combining equipment for complete switching centers or additions to existing units. Designing for unusual needs . . . corrosive or dusty atmospheres, unique space requirements, portable units, or carefully calculating tomorrow's expansion requirements . . . we are geared to handle the unusual.

Kearney Air Interrupter Switches are made in ratings up to 15 K.V.

3E's reliable Interrupter is now a Kearney product . . . unmatched for economy and safety

Write for Bulletin 152

KEARNEY

JAMES R. KEARNEY CORPORATION

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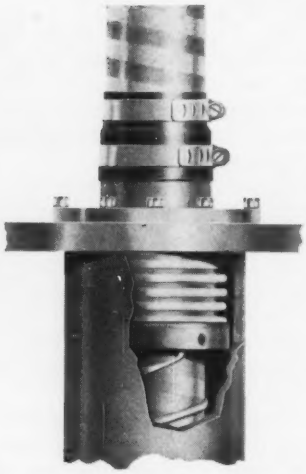


END-CLOSURE eliminates cable damage due to high holding-pressures

strain on cable connection and helps eliminate damage to paper cable resulting when conventional connecting devices are screwed down too tightly.

The end closure, or "flexible barrier," has application to semi-stop joints and potheads on high pressure, oil-filled, pipe-type systems. Installations are already in use. The patent is based on an invention by John L. Lansch, senior accessories engineer.

The Cable Accessories Division of Anaconda Wire & Cable Co is supplying the end closures on special order.

High Power Test Lab Building Is Completed

Construction has been completed on a new building at the East Pittsburgh plant of Westinghouse Electric Corp which, it is reported, will house the most powerful high-power laboratory in the United States. The multi-million-dollar project will increase the capacity of present testing facilities at the plant from 1,000,000 kva to 2,500,000 kva. The new lab will be used primarily to test power circuit breakers, manufactured at a nearby Westinghouse plant in Trafford, Pa. The testing facility will be in operation next year, after the installation of three 50,000 kva transformers, a 150,000 kva turbine generator, and related auxiliary equipment.

Up high at low cost in safety

the new **PITMAN PELICAN**™

Now your crewmen can work aloft in mechanical and electrical safety. No more bobbing ladders or dangerous, swaying crowsnests – the operator simply steps into the Pelican's fiberglass bucket, presses the easy-to-use control levers, and sweeps aloft in seconds!

The rigid fiberglass boom holds him steady with no "creep," even if hydraulic lines were to be damaged. He can change position instantly, with all the precision of a high-priced machine.

There's no longer any need to "ground" highly-skilled men when their climbing days are past. The Pitman Pelican puts them back to work – at jobs up to 40 feet high – faster and more safely than with old-style ladders or irons . . . and at far less cost than other aerial devices on the market.

Yes, the Pitman Pelican costs even less – in initial investment and maintenance – than old-fashioned powered aerial ladders. Available in 28′, 32′ and 36′ sizes; can be mounted (depending on size) on most 1 and 1½- ton trucks. Turn this page for more details . . .

for the cost of a powered ladder,

you can put your men aloft in this

PITMAN PELICAN™

the lowest-cost all-hydraulic fiberglass aerial bucket

Lightweight fiberglass bucket levels itself hydraulically, has 300 lb. capacity. Unit is designed for use without outriggers. Optional use of torsion bar assembly will increase stability. Boom revolves 360° in either direction, elevates to 75° above horizontal, extends to full reach in seconds. Entire telescoping section is fiberglass.

The Pitman Pelican is ideal for work on electrical distribution lines, street light maintenance, tree trimming and other high work. Note convenient controls on rear lip of fiberglass bucket; dual controls on truck also rotate, extend and raise boom simultaneously.

Pelican's compact design permits installation on most popular-sized utility line trucks; for example, a 28′ Pelican mounts on most 1 ton trucks. Note wide passage on either side of pedestal, making truck deck accessible.

Pelican trims for travel in moments. Operator simply retracts boom, rotates it into forward carrying position, and tips the bucket (hydraulically) up into the yoke. Overhead clearance is less than ten feet when stowed for travel.

Your nearest Pitman Distributor will be happy to demonstrate this low-cost, high-reaching aerial bucket—a card or a call will do. Or, simply contact . . .

PITMAN MANUFACTURING CO.

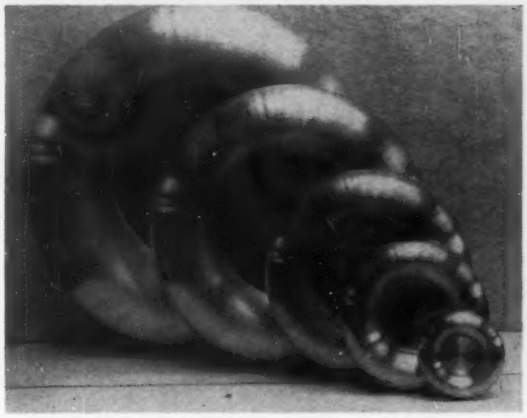
12717 Pitman Road • Grandview, Missouri
Telephone: SOuth 1-1851

PITMAN MANUFACTURING (CANADA) LTD., TORONTO

TM

New Equipment

Anti-Corona Terminations . . .



. . . increase reliability and reduce spacing requirements at potentials of up to 350 kv. The UVC termination—spheres, toroids and cap nuts— have been manufactured to geometrical configurations which have been chosen for their sharply defined corona and leakage onset characteristics. All items, it is reported, are an outgrowth of development work done by UVC to achieve corona-free terminations—reducing generated radio interference and eliminating the gradual deterioration of insulation. The spheres are used in applications to 350 kv; where space factors are critical, toroids are recommended in lieu of spheres. Cap nuts are essentially a modification of spheres and are applicable for operating voltages below 50 kv.

Universal Voltronics Corp, White Plains, N. Y.

Voltage Sensor . . .

. . . provides RSD distribution-type regulator control with simple, rapid and accurate setting of bandwidth limits. By turning one knob to the desired band width, both upper and lower limits are set simultaneously. No external instruments are required, because a readily visible scale gives accurate calibration in one-volt increments from ± 1 to ± 6 v. Neon lamps light up whenever voltage is outside of band width, one for high voltage and the other for low. Solid-state, electronic components are used to sense voltage and control a shaded pole motor-driven integrator. They are completely encapsulated and mounted on a meter-base socket.

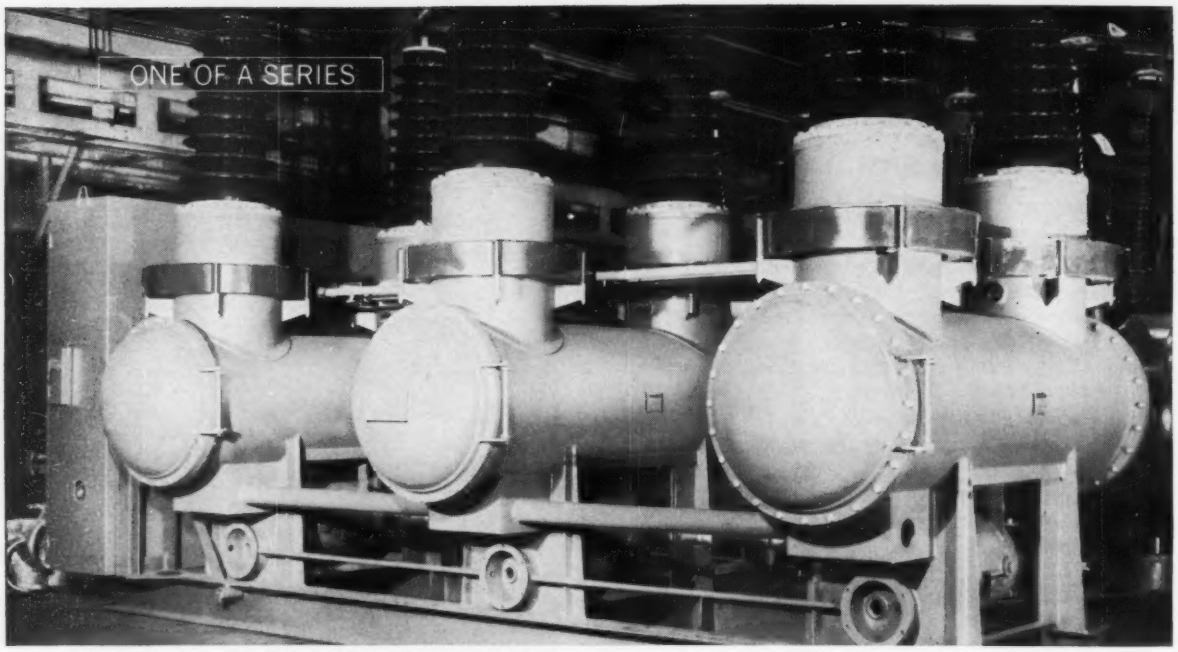
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Disconnect Lug . . .

. . . for hot-line heavy-duty tool work, as well as for manual disconnects, has only two parts and no loose pieces which can fall during installation. The U-bolt is rigidly attached and has peened ends which retain the nuts. This tee disconnect, P-U's Type KHTF, is self-keying—the disconnect lug spots in position when its recess meets a boss on the tee's tongue. Having indents on both sides, the disconnect lug can be engaged either right or left. The large, massive aluminum tongues are said to assure excellent contact. A straight disconnect of similar design, P-U Type KHLU, also has two parts and is self-keying when engaged from either side. Compression indents are made with standard tools.

Penn-Union Electric Corp, Erie, Pa.

(*More New Equipment on page* 78)



Relative light weight of SF_6 breaker and virtual elimination of ground shock reduce foundation requirement to a small fraction of that required for equivalent liquid-filled breaker.

Lightweight, Closed Gas System of SF_6 Breaker Trims Installation Costs, Reduces Operating Costs

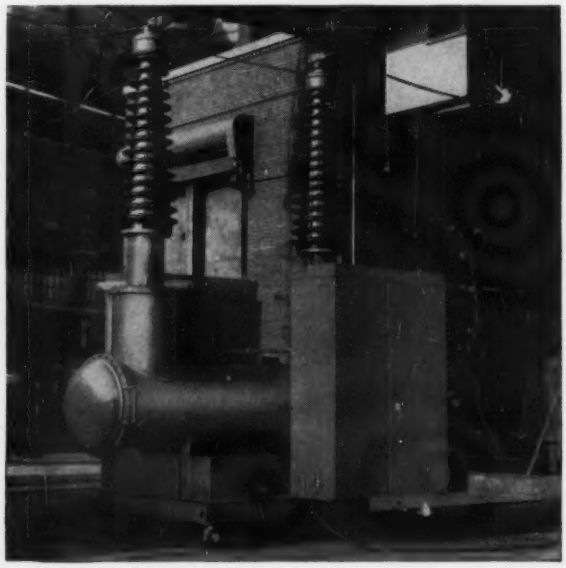
. . . provides greatly improved performance from 69 to 460 kv and beyond

Design Permits Simplified Installation

Compactness of the revolutionary new Westinghouse gas breaker design permits shipment to most locations of the completely assembled 3-pole unit in ratings through 230 kv.

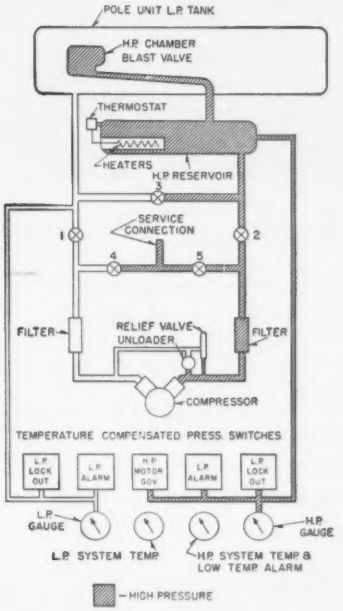
Unusual dielectric strength of the SF_6 (sulfur hexafluoride) interrupting medium permits minimum live-part to dead-tank clearances never before possible.

Foundation shock is eliminated because shock pressures associated with arc interruption are absorbed in the SF_6 gas dielectric. The picture at right shows a test pole-unit at the Westinghouse High Power Laboratory.
Note the lightweight, unanchored, wheeled cart supporting the tank. During heavy fault interruptions there was no breaker demonstration . . . only the swing of the overhead cables and the sound of mechanical operation. The breaker itself remained motionless.



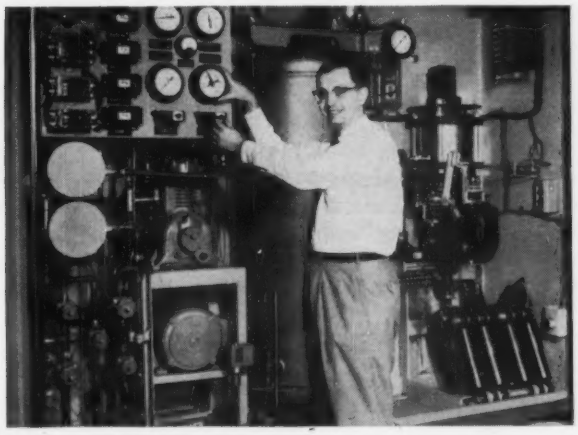
Sealed Design Assures Economy

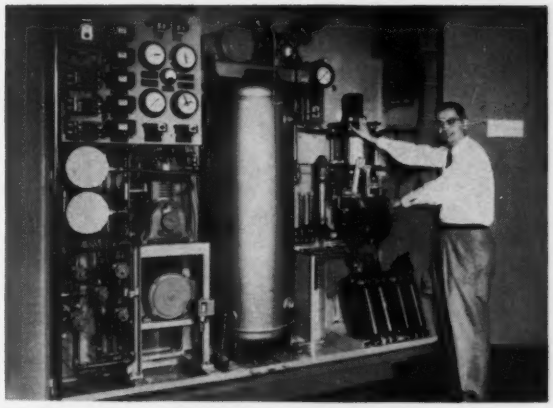
In the Westinghouse SF_6 gas breaker, a completely sealed system is used to conserve the gas used during operation. Normal gas pressure inside the pole units is maintained at a nominal 40 psig.



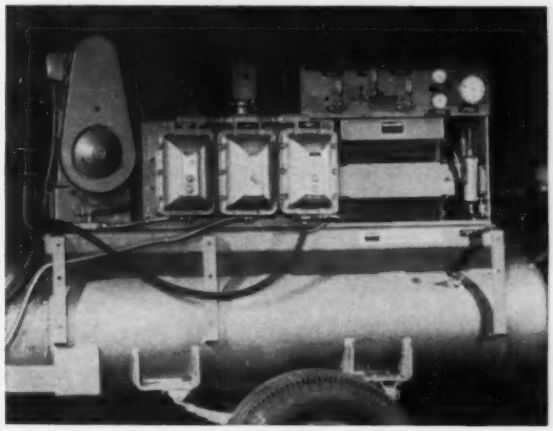
High pressure gas at 220 psig is used to extinguish the arc drawn in interruption. Gas for this operation is stored inside the pole units in a high pressure chamber. Reserve capacity is stored in individual high pressure tanks located below the main pole tanks.

The gas control system, shown below, is located in a weatherproof housing mounted on the breaker base. Temperature-compensated pressure switches operate the compressor motor to maintain high and low pressure systems at proper levels. A filtering system of activated alumina absorbs the minor by-products of arc decomposition.





A standard pneumatic mechanism, long used in Westinghouse breakers, closes the breaker contacts and compresses the accelerator springs which open the interrupter contacts. A semaphore-type mechanical position indicator shows whether breaker is opened or closed.



Seven standard size cylinders of SF_6 gas are all that are needed to charge a 230-kv breaker system. A gas handling cart, shown here, is available for temporary storage of gas during inspection and maintenance.

Get the facts about the additional savings in installation, operation and maintenance with the new SF_6 gas breaker . . . call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.* J-61010

Westinghouse

Of Course they Snap-on!
End Costly Mismatches with famous
"SIZE-MARKED"
MINERALLAC®
Jiffy®-Clips

Minerallac—the originator of the famous and widely imitated "Jiffy-Clip"—is the only company to make FOUR complete lines of these clips. The most complete choice on the market today. Fits ⅛" copper tubing and up to 6" iron pipe.

MINERALLAC HEAVY DUTY AND MEDIUM CLIPS
Made of heavier material. Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap-On" feature. Heavy-duty clips available in aluminum.

MINERALLAC MIN-E SNAP-ON CLIPS
Made of zinc plated steel. Available in ½", ¾" and 1" T.W. Also used for ½" and ¾" rigid conduit or pipe and ⅜", ½" and ¾" flexible conduit. Exclusive "Snap-On" feature.

MINERALLAC STANDARD JIFFY CLIPS
Another Minerallac "Original." Expert design and controlled manufacture have made Minerallac Standard Jiffy Clips the preference of the electrical industry for many years. These standard clips, are available in Steel and Everdur for hanging tubing, pipe, conduit and BX cable. Copper plated also available.

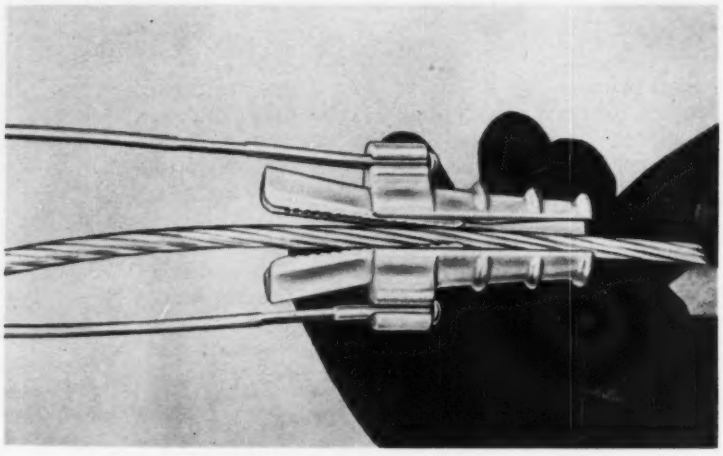
Exclusive Feature!
Each Minerallac fitting is "SIZE-MARKED". All are clearly and individually stamped with its exact size for immediate identification and quick and easy handling. Ends time-consuming guesswork and costly mismatches in the stock room and on the job.

Order from Your Electrical Wholesaler
LITERATURE OR SAMPLE ON REQUEST

MINERALLAC Electric COMPANY
ESTABLISHED 1894
25 N. PEORIA STREET • CHICAGO 7, ILLINOIS

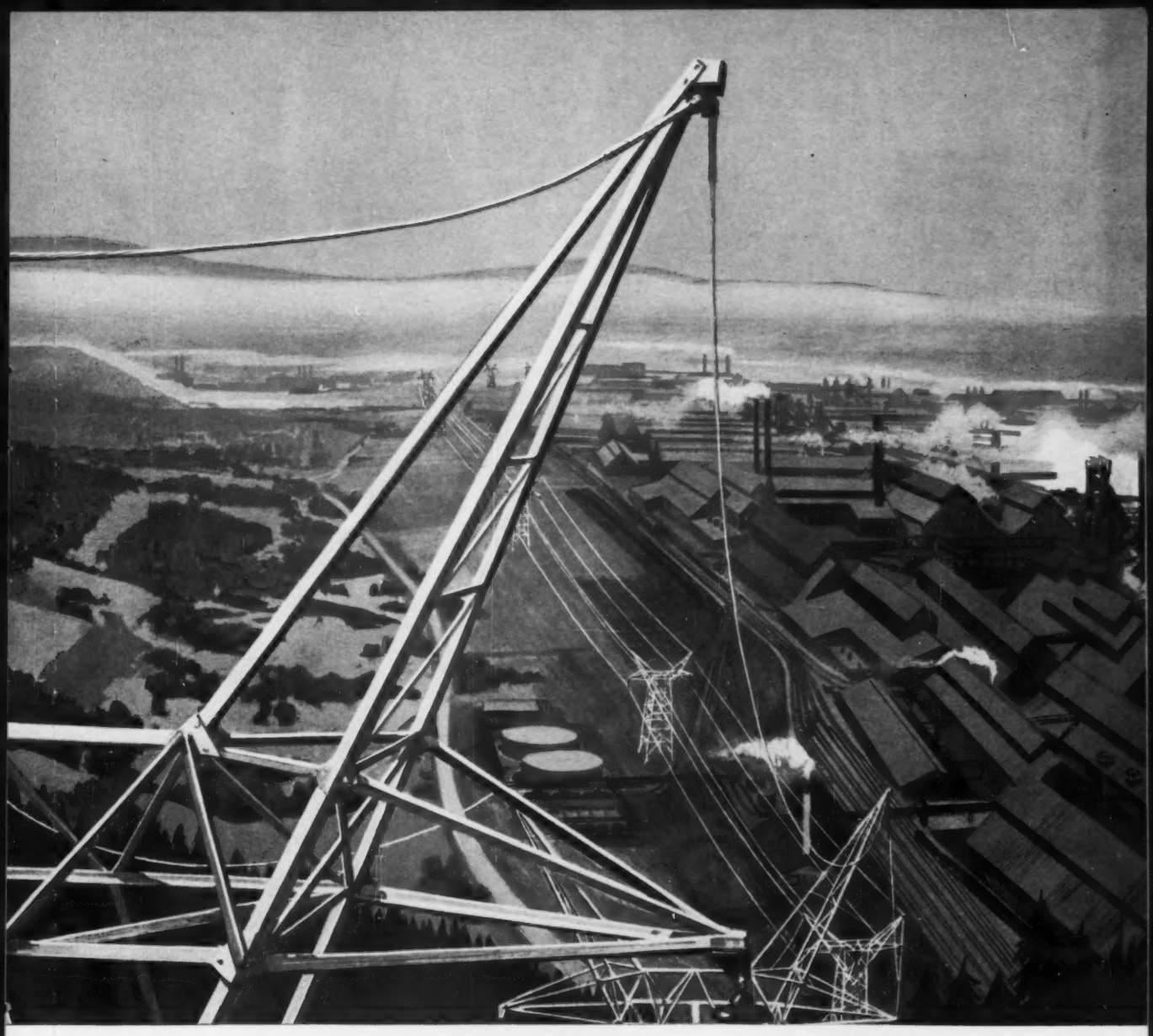
Derrick/Truck Combo . . .

. . . performs as a line truck, yet includes a full rotating hydraulic turret derrick with 12,000-lb capacity, equipped with Standard's original extensible stinger. Parallel elevating rams give turret derrick both maximum down pressure and full lifting power from depressed position. Stabilizing hydraulic outrigger jacks, self-stowing, are mounted to the truck frame to save body space. The high-torque, piston-type radial hydraulic digger requires no minimum oil flow and no gear changing for varying digging conditions.
Standard Trailer Co, San Leandro, Calif.



Side-Entrance Deadends . . .

. . . for pole or house attachment require two simple steps for installation on cable sizes No. 6 through No. 2, both AAC and ACSR, without need for threading cable or dissembling connector. Cable, at any distance from the end, is snapped into jaws of the Wejit deadend; a short, quick pull on the cable makes jaws grip it firmly. Both jaws grip cable for their full length, and tighten as pull on the cable increases because jaws move in deadend's tapered body groove. Holding power has been tested up to 1,300 lb, said to exceed pull-out load on service drop cables—even with icing and high winds. Jaws are unaffected by vibration and do not expand or lose grip under severe freezing. Major parts are of aluminum and stainless steel and reportedly effectively resist corrosion.
Burndy Corp, Norwalk, Conn.



New Bethalume Strand

Combines High Strength of Steel
with Corrosion-Protection of Aluminum

Steel

for Strength
. . . Economy
. . . Versatility

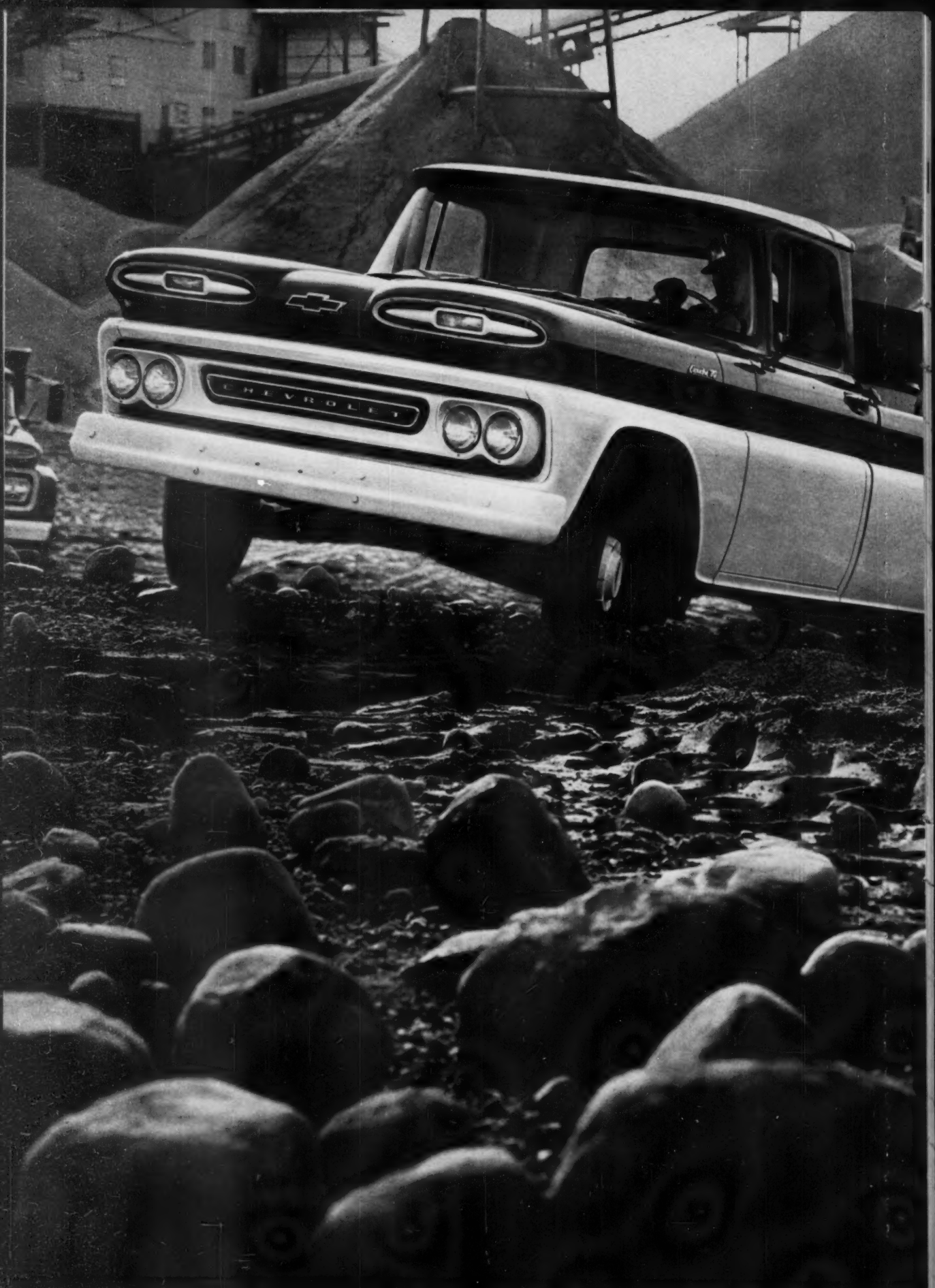
Bethalume Strand is made of steel wires to which a hot-dip coating of aluminum is carefully applied. It's ideal for use in industrial locations because of its strength and resistance to corrosion. The Bethalume coating, uniform and tightly bonded to the steel, has excellent weathering characteristics.

The Bethalume coating is recommended for messenger and guy strand, and for overhead ground or static wire. For complete information about Bethalume Strand, get in touch with the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

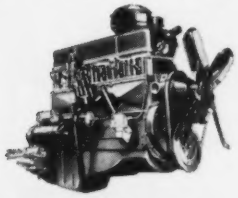
BETHLEHEM STEEL

BETHLEHEM STEEL


CHEVROLET

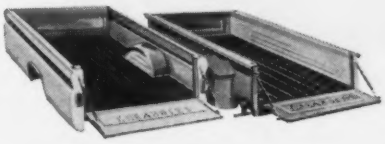
HERE'S WHY IT'S A GOOD IDEA TO GET A CHEVY PICKUP:

■ Because Chevy's wide choice of models (there are 15 of 'em!) means you'll get the *right* pickup . . . because each is engineered to the highest standards . . . because Chevy's rugged, smooth-riding build lasts longer, costs you less to own and keeps your profits at peak levels. Chances are, whatever you consider most important, you'll find Chevrolet has thought of it first, and done most about it. Whether you get a handsome Fleetside or handy Stepside model (or possibly a Corvair 95 Rampside or Loadside or one of a half-dozen four-wheel-drives) you'll soon be convinced that buying a Chevy pickup was the best idea you ever had!



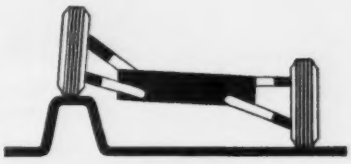
ECONOMY

The Chevrolet slant on economy makes the most sense of all, with the tight-fisted 235-cubic-inch Thriftmaster 6 (standard) leading the way. It's the most experienced money-saver going, one that's powered more payloads than any other engine in the business. It's famous for its stingy way with a gallon of gas and also for its rock-ribbed durability. It keeps your Chevy at work, making money, instead of in the repair shop, costing. And if you prefer the extra snap of V8 power, there's the eager, efficient Trademaster V8, 160-horsepower strong and available at nominal extra cost in all conventional pickup models.



CAPACITY

Chevy pickup bodies—6½, 8 or 9 feet long—are tops in cargo capacity and convenience, with a long list of bonus-built features to keep them working better and looking their best from delivery to trade-in. Both Fleetside and Stepside models feature select wood floors for better footing and quieter going, with steel skid strips to ease loading and unloading. Extra strong grain-tight tailgates with anti-rattle latches and support chains minimize bulk cargo leakage and offer firm support for extra-long loads. Fleetside body sidewalls are double-walled in the lower section, for extra rigidity and protection of exterior surfaces against dents caused by shifting cargo.

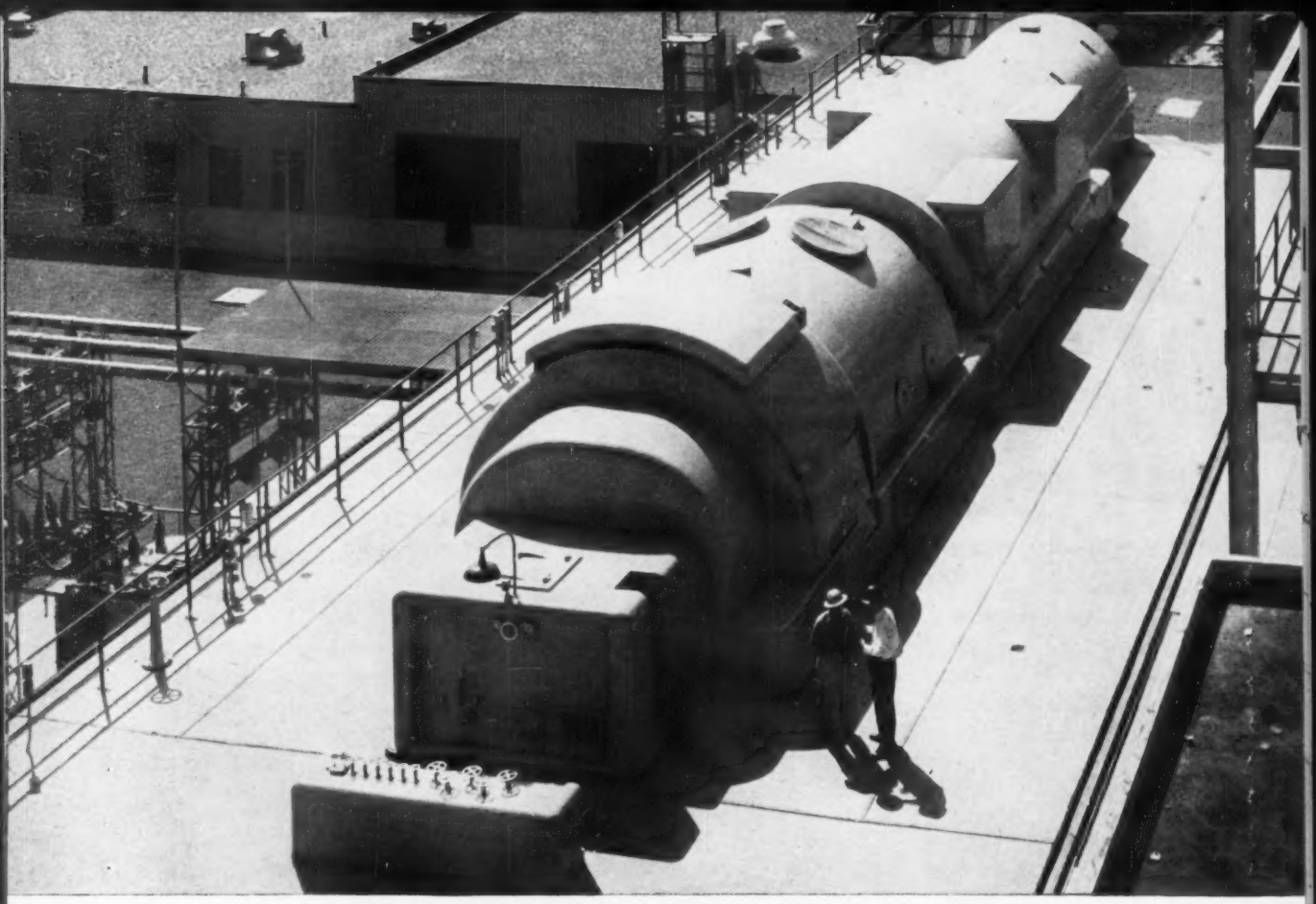


PROFIT-★★★★★-PROTECTING RIDE

All of Chevrolet's 2-wheel-drive pickups feature years-ahead Independent Front Suspension design, with ride, roadability and ruggedness that are paying off for truckers everywhere. The reduction in driving effort and fatigue that makes a bigger day's work come easy is just one part of the three-way Chevy payoff. The same shock-cushioning action protects your cargo against damage en route, and also protects the truck itself against the bumps that can batter the life out of cab, body and chassis components. Sounds too good? . . . sample it for yourself at your Chevy dealer's, soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET



General Electric's turbine-generator service teams make periodic visits to inspect, evaluate, and help you maintain your powermaker for optimum on-the-line performance.

Rx for keeping powermakers on-the-line

General Electric's prescription for keeping your powermaker on-the-line at optimum performance capability takes effect while your unit is being installed. It includes:

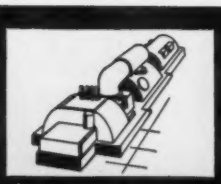
- assistance in training your operating personnel,
- periodic visits to check and discuss your unit's operation,
- assistance in planning and directing maintenance—plus prompt renewal parts procurement, and
- periodic reports on recent turbine-generator operating experience and engineering developments which may benefit your powermaker.

These are some of the "plus" services you get with a General Electric steam turbine-generator—for as long as your powermaker is on-the-line. 244-09

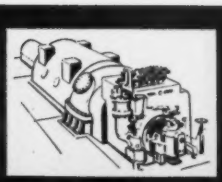
Progress Is Our Most Important Product

GENERAL ELECTRIC

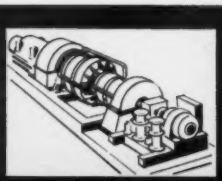
General Electric Turbine-Generators Help Keep Power Costs Low



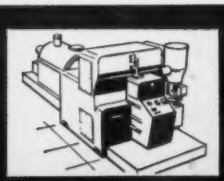
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles



Mechanical drive steam turbines for auxiliaries

Electrical World

JUNE 5, 1961

Management Newsletter

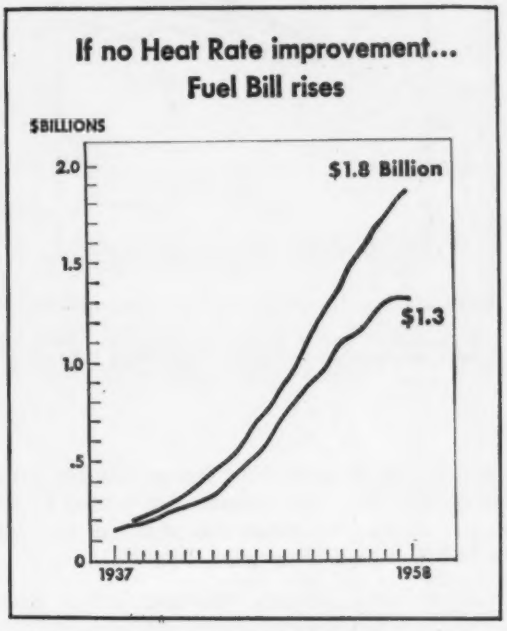


FIG 1—Top line is fuel bill without heat rate improvement. Bottom line shows actual fuel bill

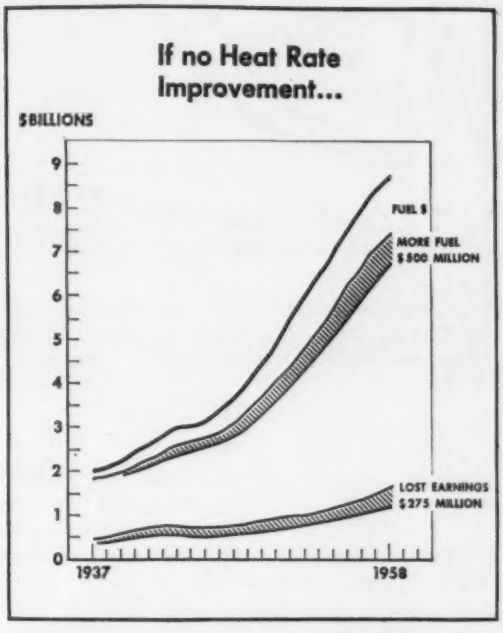


FIG 2—Assuming no change in revenue (top line) higher fuel bill would have taken bigger revenue bite

Suppliers Report on Value and Price—Part I

Events in the electrical industry over the past 1½ years have made questions of prices and values important conversation pieces throughout the industry. Recognizing the need for more information on the questions, four manufacturers have produced a 45-page book called "Prices and Values in the Electrical Industry." Allis-Chalmers Manufacturing Co, General Electric Co, Ingersoll-Rand Co, and Westinghouse Electric Corp are the four companies.

The first portion of the book, from which the following information and charts were taken, is "an evaluation of progress" over the period from 1937 through 1958. The evaluation is based on historical records for investor-owned electric utilities as contained in Federal Power Commission reports, Edison Electric Institute reports, Handy-Whitman Cost Indexes, *Electrical World* surveys, and similar sources.

The challenge the utilities have faced is rather staggering. Load has gone up 400%, construction costs up 180%, and yet the price of electricity has gone down while return on investment has held at a remarkably steady level.

A concerted attack on technical and economic problems by manufacturers and utilities together is credited in the report with making these achievements possible. It asks these questions: "What if this attack on industry problems had not been made? What if progress had stopped back in 1937 and no further technological advances had been made after that time?"

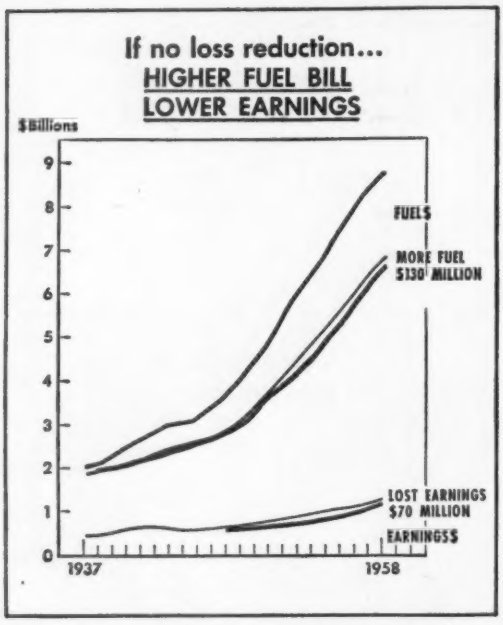


FIG 3—Again assuming no change in revenue (top line) higher fuel bill would have taken bigger revenue bite

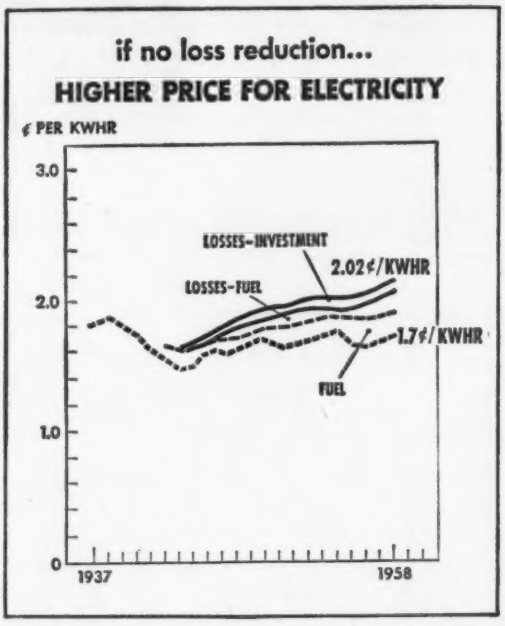


FIG 4—Bottom line is actual average price. Spaces between lines are increments that would have been added

If that had happened, the average customer would now be paying 3.3¢ per kwhr instead of 1.7¢—an increase of more than 90%. This assumes that utilities would have been able to get rate increases to maintain the historic rate of return. Without rate increases, earnings would be –3.8% instead of the present 5.8%.

But progress did not stop, and great technical advances were made in four main areas of operations: fuel costs, system losses, investment charges, and manpower.

Taking fuel first, the study shows the effect of progress in the heat rate on fuel expenses of Class A and B utilities (Fig 1). Some contributing factors were in metallurgy, design, the successful development of reheat, more efficient station apparatus, and advances in operation of the improved equipment.

In 1937, the "good" new unit had about a 14,000-Btu heat rate compared to the industry average that year of about 17,850 Btu. If advances had not been made, the study says, cost of fuel in 1958 would have taken $500 million more out of revenues (Fig 2), if rates had stayed the same. Units would be using 1.25 lb of coal per kwhr generated instead of 0.9 lb. Supposing that the average price of electricity had not been allowed to increase, the reduction in earnings would be about $275 million, and return would have sagged from 5.8% to 4.95%.

The next area of progress examined is system losses. Improvements in transformers, use of higher voltage systems, and improved system engineering have reduced losses from 16.3% to 10.3% of generated energy. Results are smaller fuel bills, less generation, transmission and distribution capacity, and lower investment. If the improvements had not been made, utilities would have spent $130 million more in 1958 for fuel, resulting in a $70-million reduction in earnings (Fig 3). The higher investment in additional facilities would also require higher revenues.

Translating additional fuel required and added capital charges to a price chart, and assuming that rate of return could be maintained, losses add two more layers to the price curve (solid lines, Fig 4) to bring the price to 2.02¢ a kwhr, making it 10% higher than with poor heat rate alone (top dotted line).

Investment—the third area where progress has been achieved through improved technology—is an especially critical factor in the electric utility industry. There is a

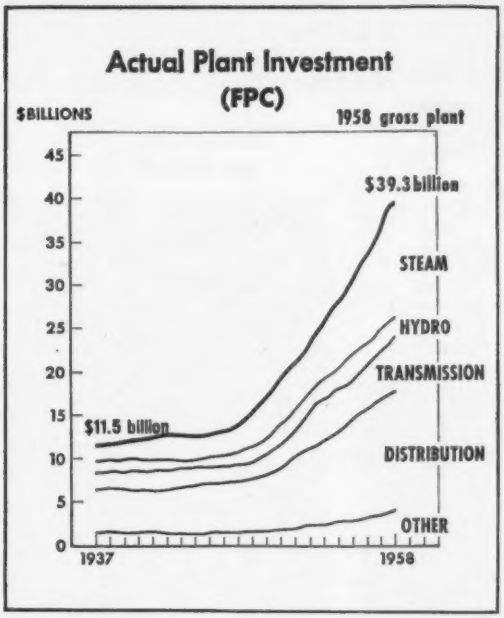


FIG 5—Total actual plant investment (top line) is broken into its various components (spaces between lines)

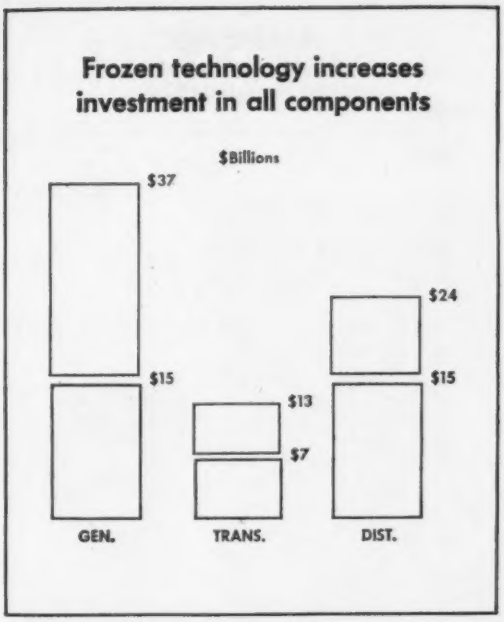


FIG 6—Upper boxes are additional investment that would have been required. Lower boxes are actual investment

ratio of dollars in plant investment to annual revenue of more than four to one—one of the highest for any industry.

From 1937 to 1958, total gross plant investment for Class A and B investor-owned utilities rose from $11.5 billion to $39.3 billion (Fig 5). More than 90% of added generating capacity included was steam, and construction costs provided the big challenge. If there had been no progress in equipment after 1937, the cost per kw of steam plants might well have followed the construction cost index very closely. But this did not happen. The average dollars-per-kw cost of steam plants rose from $110 to only $145.

Suppose the steam plant investment had followed the Handy-Whitman Index. The investment by 1958 would have been an additional $8.6 billion—even without allowing for extra capacity for system losses.

The report applies similar analyses to other components of the system with these results (Fig 6):
Total investment in generation would have risen from $15 billion to $37 billion;
Transmission investment would have climbed from $7 billion to $13 billion;
Distribution investment would have climbed from $15 billion to $24 billion;
Total system investment would have risen from $39 billion to $79 billion.

The challenge of manpower has been met with equal success. While the average annual wage per employee has climbed from $1,500 to $5,900, the annual wage per kw has remained almost constant. The investor-owned utilities employed about 251,000 persons in 1937, and the number is about the same today. Consequently, the number of employees per Mw of generating capacity has dropped from 7.8 employees down to 2.5. If the same Mw-employee ratio were true today, there would be about 750,000 on utility payrolls.

"Obviously, things would not actually have happened this way," the report states. Investor-owned utilities could not have operated with declining earnings, and rates could not have risen unchecked. Two bad trends would have developed: rates would have gone up, and consumption would have declined. This in turn would have made it difficult to attract capital.

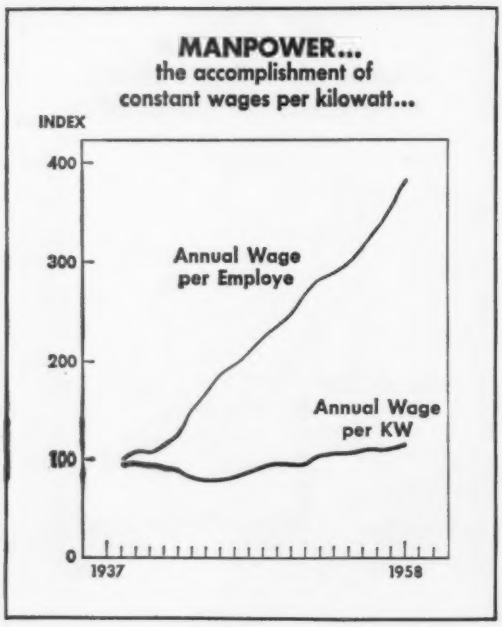


Fig 7

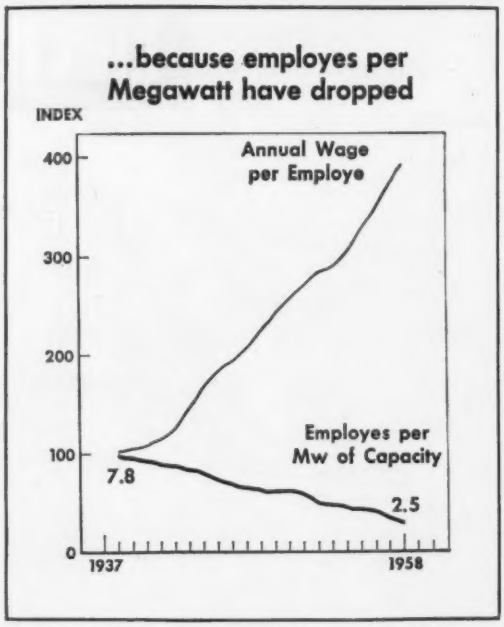


Fig 8

The report finally summarizes: "Without the tremendous technological advances which have been made in the electrical utility industry, these kinds of changes in important parameters of the utility industry might well have occurred:" Total system investment—up 100%; Price of electricity—up 95%; Rate of return—to —3.8% (Figs 9-10).

If utilities had received 1937-type equipment free from manufacturers all these years, what would the effect be now? The report says that the $79 billion investment that might have been (without technical advances) would have been reduced only to $63 billion—still $24 billion higher than the $39 billion in 1958.

(Composite price behavior will be presented next week)

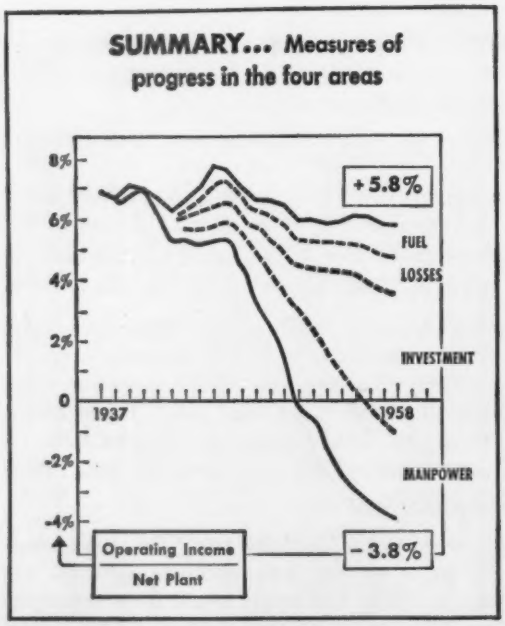


FIG 9—With no increase in price, and without technical advances, rate of return would have been driven down

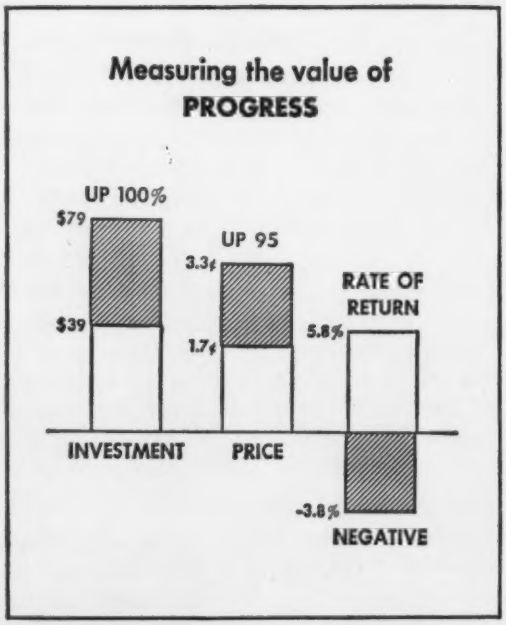
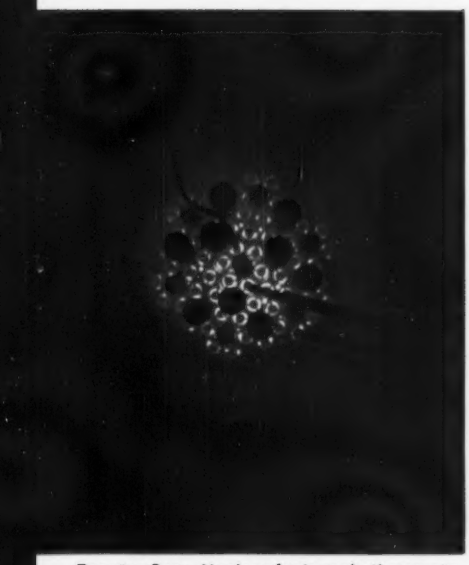
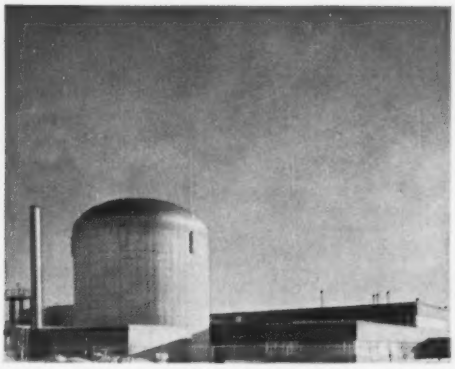


FIG 10—Shaded areas show what would have happened if there had been no technical advances

60,000 kw Westinghouse testing reactor speeds radiation tests for industry and government



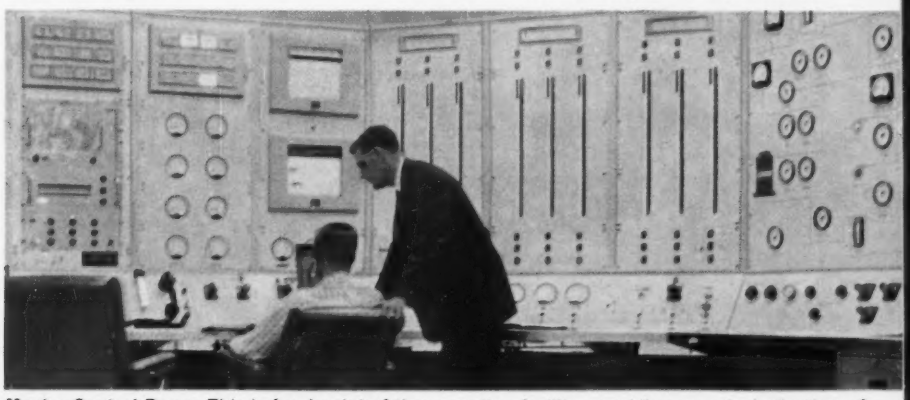
Reactor Core. Nuclear fuels and other materials can be tested inside cylindrical fuel elements.



Testing Reactor Facility. Most powerful privately-owned complete facility in U.S. Available to serve industry and government.

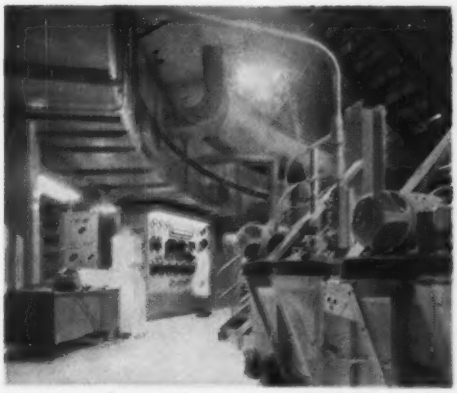
Critical Experiment Station. Low power test facility used to confirm physics of experiments before exposure in the reactor.

Remote Handling Facility. Hot cells and metallographic cells are available for post-irradiation examination of samples.



Master Control Room. This is focal point of the operating facility; providing remote indication of reactor performance and experimental conditions.

Complete Laboratory Facilities. Chemical, analytical and counting laboratories are used to make post-irradiation tests.

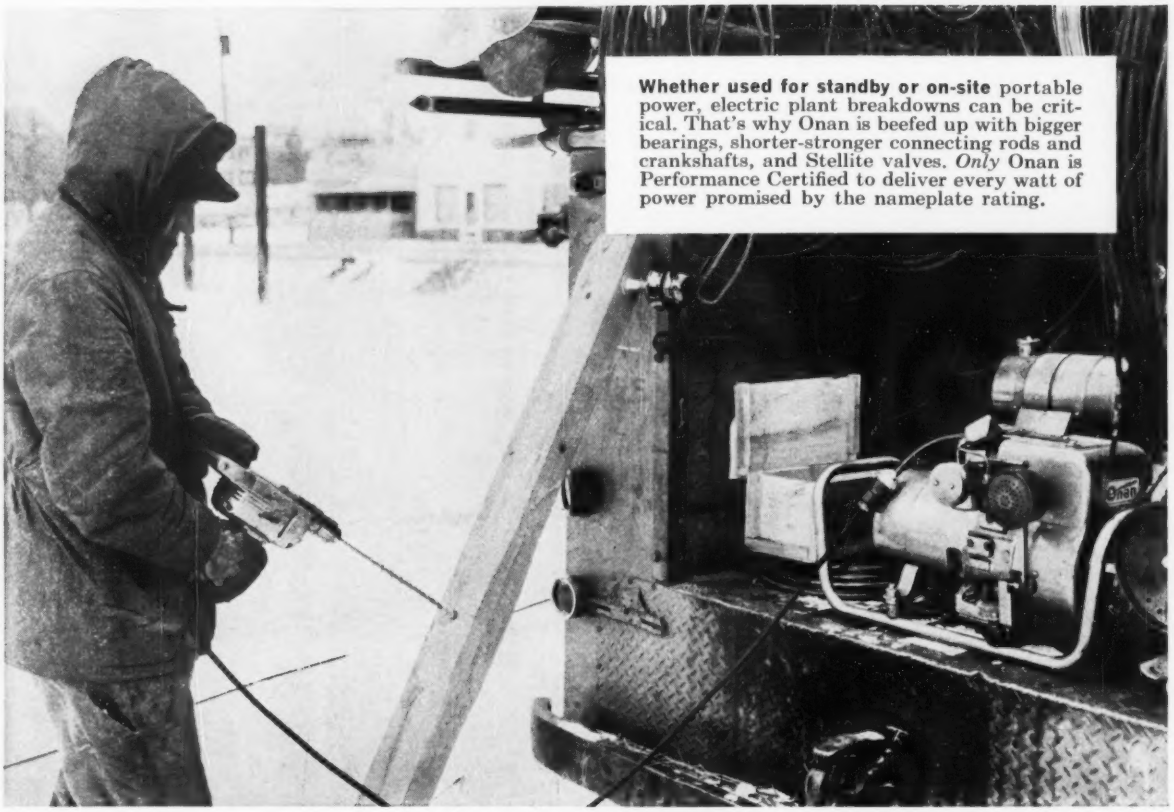


Test Loop Control Center. Loops are available to provide a variety of environmental conditions during irradiation.

J1-59502

Westinghouse

Westinghouse Testing Reactor
Box 868, Pittsburgh 22, Pa.



Whether used for standby or on-site portable power, electric plant breakdowns can be critical. That's why Onan is beefed up with bigger bearings, shorter-stronger connecting rods and crankshafts, and Stellite valves. *Only* Onan is Performance Certified to deliver every watt of power promised by the nameplate rating.

Only Onan is certified to give you all the power promised by its nameplate

It's a fact that many electric plants on the market today do not deliver the output promised by their nameplate rating.

Every Onan plant is given a rugged workout *under full load* before it is shipped—*your assurance* that the Onan you buy is ready for hard work the day you get it.

But this isn't enough. Independent laboratory inspectors pull surprise inspections to double-check our tests and testing methods. They pull a plant off the line, run it, stop it, load it, overload it, check and recheck. Their torture test gives positive proof of Onan's quality. End result: *Onan's exclusive Performance Certification* . . . your assurance of getting every watt of power you pay for.

So when you're tempted by an electric plant "bargain," make sure its nameplate rating is not "inflated." Be sure you're getting full measure for your money. Remember, *the electric plant that shortchanges you in power output is no bargain at any price!* Only Onan is Performance Certified to deliver everything the nameplate promises.

See Onan electric plants soon. Compare before you buy. You'll find your Onan distributor listed in the Yellow Pages. Call him or write direct.

PERFORMANCE CERTIFIED
We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
Onan
Onan
World's Leading Builder of Electric Power Plants

Onan

ONAN Division, Studebaker-Packard Corporation, 2589 University Ave. S. E., Minneapolis 14, Minn.

Edison's Electric Light

(*Continued from page* 49)

length of the laboratory. To these he connected lamp after lamp by merely fastening little wires to each of the parallel supply wires and then attaching them to the lamps. The illumination or the extinguishment made not the slightest perceptible difference in the strength of the current. Twenty electric lamps burned with exactly the same brilliancy as did one when the other 19 were disconnected. The light given was of the brilliancy of the best gas jet, perhaps a trifle more brilliant. The effect of the light on the eyes was much superior to gas in softness, and excited the admiration of all who saw it."

Success

The next edition of the *Operator* is able to describe Menlo Park on New Year's Eve, the first community lighted by incandescent lamps.

Now Edison turns to the first commercial use of his light. He begins work on a lighting system for downtown Manhattan, and breaks ground for a generating station at Pearl St. But another company, even though using a less efficient lamp, is racing him for the first commercial installation. A letter to the *Operator* urges:

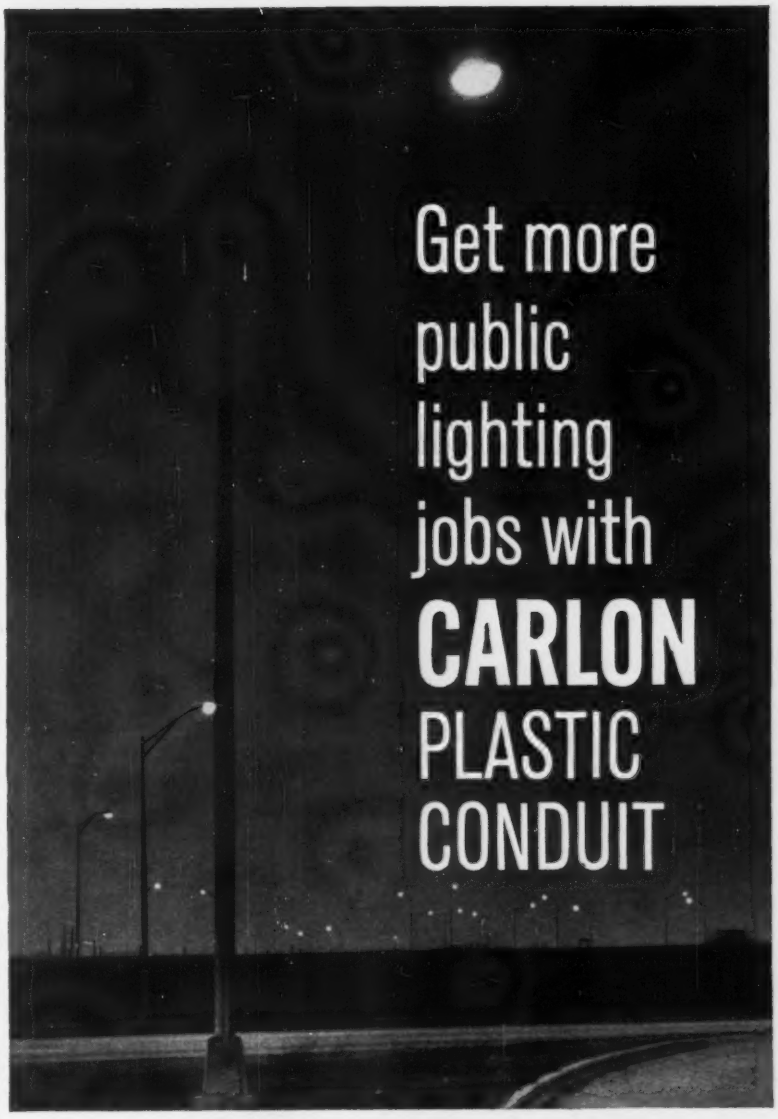
"Hurry up Edison . . . the Brush Electric Light Co is already erecting 20-ft lamp posts along Broadway from Union Square to 34th St."

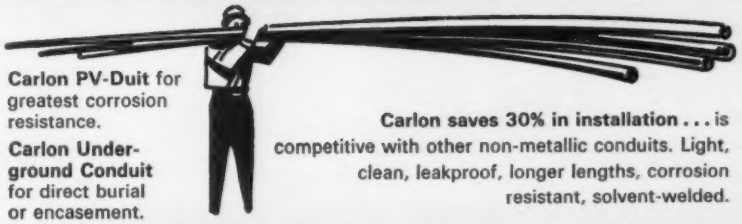
But by August 1, 1882, the *Operator* is able to headline that Edison's first district is completed. The area bounded by Spruce, Nassau, and Wall Streets, and by the East River is wired, and the Pearl St Station is ready to operate. There will be some delay for further testing.

On Sept. 15th of the same year, the *Operator* reports the successful inauguration of the Edison Electric Lighting System. It quoted Edison as saying:

"I have accomplished what I promised. It was not without some fear that I started the machinery this evening. I half expected that some new phenomena would interfere with the working of the light. But it has been entirely successful."

Successful indeed. The *Operator* says that applications for connections are numerous. And over 3,000 lamps are already connected.





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Carlon Underground Conduit for direct burial or encasement.

Carlon saves 30% in installation . . . is competitive with other non-metallic conduits. Light, clean, leakproof, longer lengths, corrosion resistant, solvent-welded.

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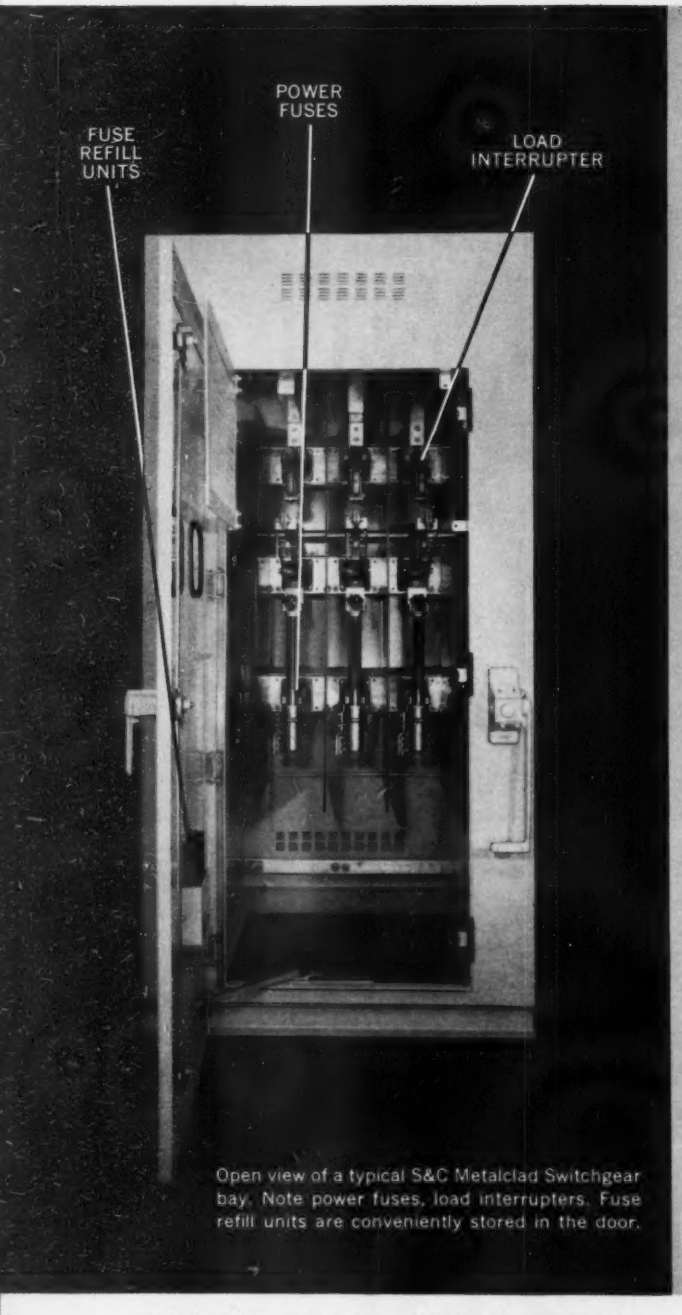
Reclosing is for the birds



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

But when faults occur on the enclosed power supply circuits of industrial plants, commercial and institutional buildings, you don't want to reclose on them. These faults —while extremely rare—are permanent. Someone has to locate the trouble and repair the equipment or cable—or at least isolate it—before the system can be re-energized. So why buy expensive circuit breaker type switchgear with its automatic reclosing feature?

S&C Metalclad Switchgear—employing fused load interrupters—gives the ideal protection for enclosed power supply circuits. Power fuses furnish the fault protection (load interrupters switch the load). After a fault occurs, you simply replace the inexpensive fuse refill unit (typically costing $13.50) while the fault is being located and corrected.

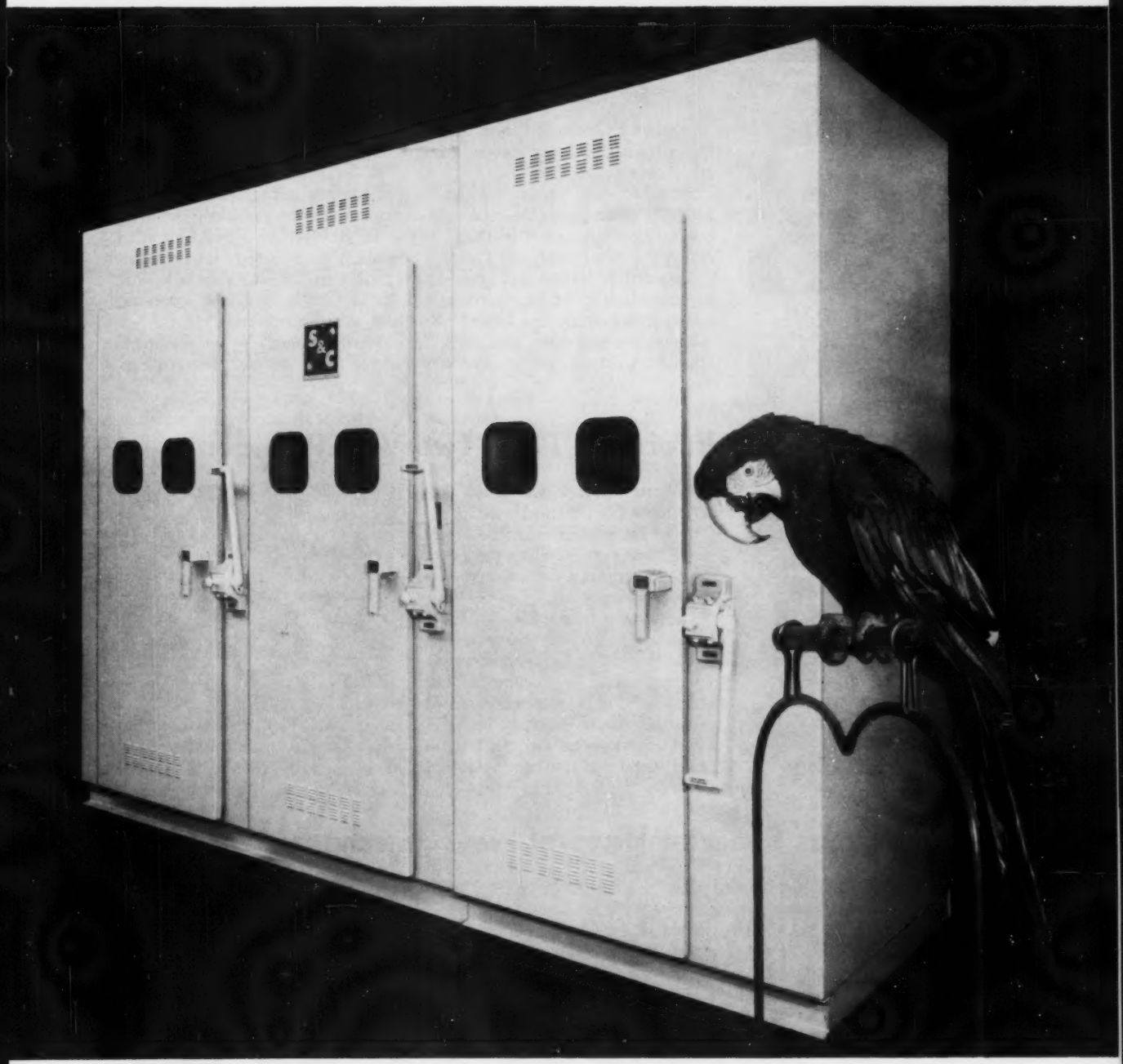
The economics all say, "Reclosing is for the birds." Why pay for a function you can't use?

Cut your high-voltage switchgear costs in half by specifying S&C Metalclad Switchgear for your 2.4 thru 14.4-kv switching centers, service entrances, substation primaries and secondaries. Get full-load switching to 1200 amperes and fault interrupting to 500,000 kva.

See the Yellow Pages (Electrical Equipment) for your nearest S&C sales engineer. Or write to:

S&C Metalclad Switchgear meets all NEC requirements for fault-closing, short-circuit interruption. Performance proved by high-power testing at KEMA laboratories.

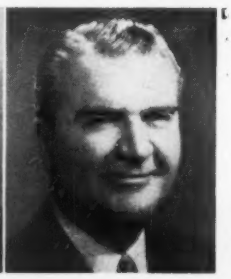
S&C ELECTRIC COMPANY
4421 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911



The equipment is an S&C Metalclad Switchgear Assembly rated 13.8 kv, for a switching center.
The bird, a green-winged macaw, is an optional extra, obtainable at your local petshop.

News About People

McGRAW



LARGE

Merged Utility Officers Set

Southern Colorado Power Co has been merged into Central Electric & Gas Co and the latter company has changed its corporate name to Western Power & Gas Co.

Max McGraw was elected chairman of the new corporation and Judson Large became president. Elected as executive vice presidents were Col L. D. Densmore, Toral F. Duckett, and D. B. Hyer Jr. Also, Kenneth L. Dally, William Porter, and Duane T. Swanson were named vice presidents.

Leonard T. Nelson was appointed secretary-treasurer; Kenneth L. Pohlman, controller; M. A. Hardies and R. M. Miller, assistant secretaries-assistant treasurers; and Keith L. Knudsen, assistant secretary.

Upon merging with Central E&G, Southern Colorado Power became the Southern Colorado Power Co division of the newly dubbed Western E&G.

DENSMORE

DUCKETT

HYER

DALLY

PORTER

SWANSON

Interstate Picks Two Vice Presidents

Robert W. Steele and Oscar Solberg have been named vice presidents of Interstate Power Co. Steele was formerly assistant to the president; Solberg will continue as secretary and treasurer.

Steele joined Interstate in 1941. After service in the Navy during World War II, he returned as a resident engineer. He became a staff assistant in 1954 and was boosted to assistant to the president in 1957.

Solberg has been with the organization since 1921, when he joined Interstate's predecessor company. He became secretary and treasurer in 1938.

STEELE

SOLBERG

Moloney Names Spackler Head of New Switchgear Division

Moloney Electric Co has appointed Donald E. Spackler general manager of its new switchgear division. With the company since 1950, Spackler has been a vice president for seven years. He played a major role in the development of the company's 5 and 15-kv metal-clad switchgear.

Carl E. Mercier has been chief design engineer during the development. For 17 years prior to coming to Moloney, he specialized in switchgear engineering and, in particular, dielectric, thermal, and interrupting properties of switchgear.

For the complete story on the development of Moloney's switchgear, see page 70.

SPACKLER

MERCIER

(*More News About People on page* 94)

MODULAR DESIGN OUTDOOR SUBSTATIONS MEET YOUR NEEDS QUICKLY AND ECONOMICALLY

Versatile, pre-designed structure components are the key to Westinghouse modular design outdoor substations. You simply furnish a station one-line diagram, arranged to indicate relative location of major apparatus and direction of supply lines and feeders — and let experienced Westinghouse substation designers do the rest.

Under the Westinghouse modular plan, you get:

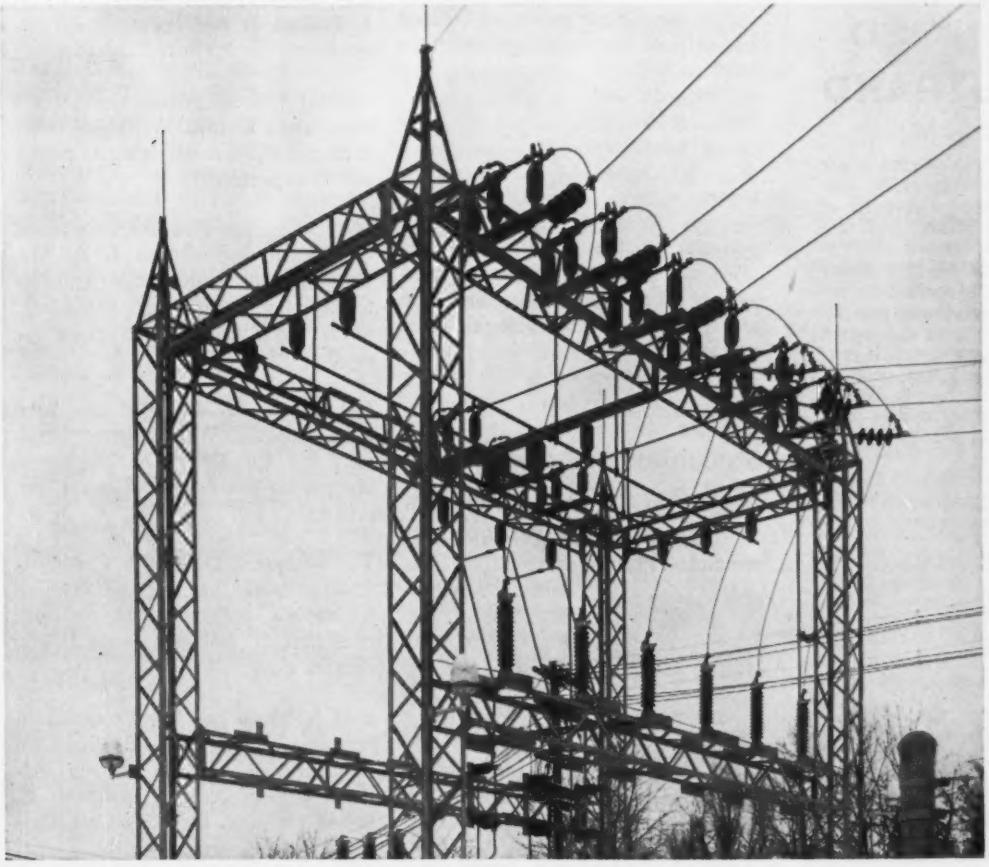
- *Tailored Station Design*. . perfectly suited to virtually any layout, using pre-designed components.
- *Economy in Steel*. . maximum strength-to-weight ratio, through proper component selection.
- *Easy Field Erection*. . through use of interchangeable members, which eliminates shop errors and permits rapid assembly.
- *Superior Product Integration*. . through single-manufacturer responsibility.
- *Simplified Planning and Fast Delivery*. . from single-line diagram to shipment of the ready-to-erect substation, this modular technique requires minimum time.

Let Westinghouse design and coordinate your outdoor substation under the modular plan. For complete information, call your Westinghouse representative or write Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.

You can be sure . . . if it's Westinghouse

Westinghouse

Pennsylvania Electric Company's West Sayre substation shown here is a good example of a substation planned and built with Westinghouse modular design components.



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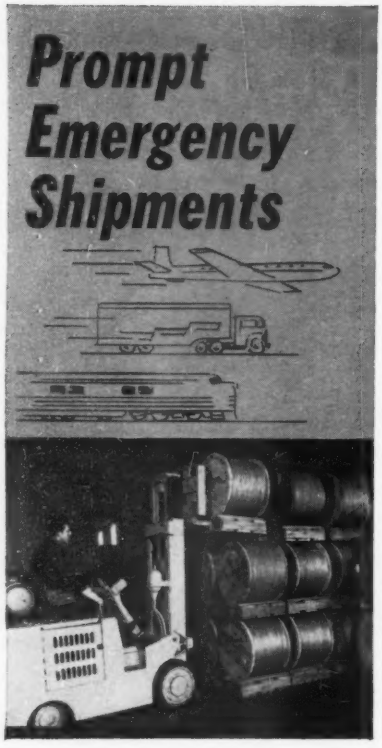

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When in need of guy or messenger strand during an emergency, be sure to contact the nearest distributor of **Crapo** Galvanized Strand! Substantial stocks are maintained at strategic distributing points throughout the country ready for immediate delivery. Back of these stocks are our own extensive mill stocks of finished strand, and strand in process. If your jobber does not have all of your requirements, he knows he can depend upon us for immediate shipment of popular sizes and grades by air, truck or rail.

You, in turn, can rely upon **Crapo** Galvanized Steel Strand, at all times, to give you the utmost in performance at reasonable cost.

Crapo Galvanized Steel Strand is manufactured in all standard sizes and grades and in three weights of coating: Class A, B and C.

Phone the distributor of **Crapo** Galvanized Steel Strand near you the next time you need strand.

INDIANA
Steel & Wire Co., Inc.
Muncie, Indiana

Willis Named President of Jamaica PS

Robert H. Willis has succeeded Richard N. Benjamin as president of Jamaica Public Service Ltd. Benjamin did not stand for reelection at the directors meeting.

Benjamin is president and Willis vice president of Stone & Webster, Inc.

ROBERT H. WILLIS

Hubbard & Co Appoints VP

Hubbard & Co has elected George Pope vice president-manufacturing at the firm's Cicero, Ill., pole line hardware plant.

Pope joined Hubbard two years ago as manager of manufacturing. He was formerly manager of Metal & Thermit Corp plants in Chicago and New Jersey.

Okonite Boosts Brown to Distributor Sales Post

Okonite Co has promoted Wilfred L. Brown to manager-distributor sales. Okonite is the wire and cable manufacturing subsidiary of Kennecott Copper Corp.

Since joining Okonite five years ago, Brown has served as manager of product advertising and then as assistant to the general sales manager.

Mullenbach Is General Manager of E-M Division

Robert J. Mullenbach has been appointed general manager of Electric Machinery Manufacturing Co's control division.

MULLENBACH

Mullenbach was formerly a consultant and general manager of Mullenbach division of E-M in Los Angeles.

PERSONAL BRIEFS

At Carolina Power & Light Co, **W. J. Ridout Jr** has been named agricultural development director.

Central Illinois Public Service Co has chosen **Gerald V. Keeley** to be manager of its newly created public affairs department.

Hydro-Electric Power Commission of Ontario has chosen **J. R. McCullough** to assume responsibility for its Niagara and west central regions, in a move to integrate the two.

Col James H. Beddow has been named Walla Walla district engineer for the Corps of Engineers, succeeding **Col Paul H. Symbol** who retired.

The Maryland District of Columbia Utilities Assn has elected **William S. Moore** president. He is vice president of Eastern Shore Public Service Co.

Bud S. Moss has been boosted to manager of Georgia Power Co's merchandise division at its Atlanta general office. **Andrew B. Speed** replaced Moss as Columbus division sales supervisor.

Douglas County PUD has named **Horace Fleming** distribution superintendent.

At Dallas Power & Light Co, **Richard S. Miner** has become assistant head of the distribution department, and **William D. Jordan** became head of the substation and transmission division.

Consulting engineering firm of Stevens & Conkling has been formed by **Jack D. Stevens, Roger L. Conkling** and **Robert O. Wilson,** with offices in Seattle and Portland.

At New England Electric System, **Richard J. Lyman** has become personnel director; **Fred A. Donovan,** assistant to the president of Merrimack-Essex Electric Co; **V. Charles Otten,** assistant comptroller, New England Power Service Co; **Thomas C. Kenefick,** comptroller, Lynn Electric Co; and **Louis J. DeAngelis,** executive assistant at Narragansett Electric Co.

S. N. Fiala has been elected a director of American Electric Power Co. He is a vice president.

Savannah Electric & Power Co has elected **E. G. Neikirk Jr** secretary and treasurer.

Anthony A. Jedrziewski has become supervisor of distribution planning for West Penn Power Co.

The American Institute of Electrical Engineers has awarded the 1961 Lamme Gold Medal to **Dr John G. Trump** of Massachusetts Institute of Technology.

At the Chicago operations office of the Atomic Energy Commission, **Thomas A. Nemzek** has been appointed assistant manager for technical operations, succeeding **Milton Klein** who became deputy director of the AEC-NASA office attached to the AEC's division of reactor development. **Claude A. Pursel** was named director of reactor engineering division.

W. H. VandeHei has been named Oshkosh division manager of Wisconsin Public Service Corp, succeeding **E. S. Schrank** when he retires July 1. **R. B. Fick** will replace VandeHei as manager of the Wausau division southern district.

The new manager of state and local government department, marketing division of Minneapolis-Honeywell Regulator Co's electronic data processing division, is **J. B. Parsons.**

William W. Alving has been named manager of the newly formed sales department of Telsta Corp.

Yougene J. Lamar has been appointed director of product planning-data processing systems at Burroughs Corp.

Gould-National Batteries, Inc, has named **S. E. Opstad** western manager and **John R. Knobloch,** account manager, both in the national account sales division.

National Assn of Electrical Distributors has elected **B. H. Boatner,** president of Westinghouse Electric Supply Co, as president for the year. **John M. Newton Jr,** president of Oakes Electrical Supply Co, was elected NAED's vice president-eastern region, while **John W. Shealy,** president of Shealy Electrical Wholesalers, Inc, was elected vice president-southern region.

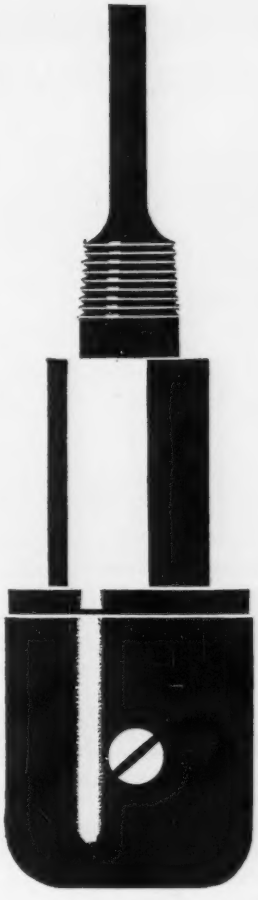
Verne O. Clements has been appointed assistant to the vice president in Westinghouse Electric Corp's southwestern apparatus sales region. **William M. Oliver** became manager of the south Texas district.

At Thompson Ramo Wooldridge Inc, **J. S. Webb Jr** has become assistant to the president, New Enterprises. **C. R. Allen** was named director of finance for west coast operations. **Robert S. Putnam** joined Pacific Semiconductors, Inc, subsidiary of TRW, succeeding **Joseph C. Ross** who became division manager, Micro-Electronics.

Cornell-Dubilier electronics division of Federal Pacific Electric Co has established a market research and product planning department, with **Glenn A. Dusch** as director.

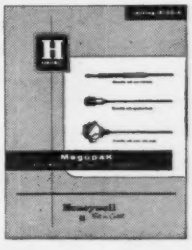
Warren C. Hume is the new general manager of International Business Machines Corp's data processing division.

At Atomics International division



MegopaK
THERMOCOUPLES

Honeywell's new line of hard-pack, small-diameter, mineral-insulated thermocouples. Available as bulk material (combination of wires, insulation and sheath); elements (with measuring junction); and as complete assemblies (with terminations and mounting attachments). From this one dependable source come thousands of other accessories to make your instruments perform at their very best.



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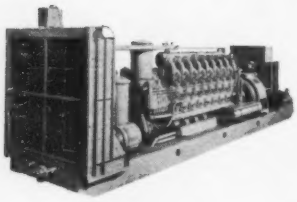
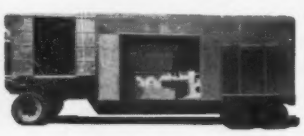
First in Control
SINCE 1906

DIESEL POWER that's ECONOMICAL!



Portable and Rental Units

Diesel engine generator sets from 100 to 1100 kw, 125 to 1375 kva, completely portable, easily transported, quickly installed, designed for parallel operation, 60 or 50 cycles. A "Central Station" in itself, independent, self-contained.



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HA-3

of North American Aviation, Inc, **Edward F. Weisner** has become project engineer for preliminary design of the 150-Mw organic moderated and cooled reactor for Baden Wurttemberg Nuclear Power Plant Planning Assn of Germany. **Jack Jacobsen** succeeded Weisner as project engineer for the Piqua (Ohio) nuclear power facility.

George E. Watkins has been appointed director of the new research division of Edison Electric Institute.

New executive assistant to the president of Thor Power Tool Co is **Milton E. Slater.**

General Electric Co has named **Robert L. Aughenbaugh** manager-manufacturing for heat processing equipment at the industrial heating department.

Donald E. Calmer has been named manager of General Electric Co's new installation practices-electrical unit in the installation and service engineering department. **Frank M. Prescopio** was promoted to engineering manager for the wire and cable department. **Dan C. Kyker** has been appointed materials manager for the outdoor lighting department. In the power transformer department, **Christopher T. Kastner** became manufacturing manager. GE realigned its industrial marketing organization in Schenectady and established six new managerial posts. The new positions and the managers appointed are: systems procedures and practices manager, **David A. Yates;** industrial sales and engineering manager, **Charles B. Elledge;** metal rolling industry sales manager, **George R. Brown;** metal rolling application engineering manager, **William E. Miller;** advance planning and projects manager, **L. Frank Lewis;** and application engineering development manager, **F. Morley Roberts.**

General Electric Co has appointed **Patrick J. Bingham** manager of engineering administration in the gas turbine department, succeeding **V. A. Sheals** who retired. **William Naas** became sales engineer for residential controls at the appliance control department. **Eugene B. Sanford Jr** assumed the post of administrator-professional relations, electric utility engineering operation.

OBITUARIES

Henry Harrison Kuhn, 70, retired senior vice president and director of Kansas City Power & Light Co . . . **Ralph Waldo Atkinson,** 73, retired director of research for General Cable Corp . . . **Elwood T. Martin Sr,** 67, who was the Upper Darby office manager for Philadelphia Electric Co . . . **Daniel Lest Diehl,** 57, industrial development director for Pennsylvania Light & Power Co.

Edgar S. Clark, 75, retired electrical engineer of Hawaiian Electric Supply Co . . . **Robert C. Davenport,** 68, former construction engineer, Louisville Gas & Electric Co.

John H. Trumbull, 88, president of Trumbull Electric Co prior to its purchase by General Electric Co . . . **Edgar R. Adams,** 69, retired electrical engineer and salesman for GE's apparatus department.

Dynamic Distribution Sketched

(*Continued from page* 56)

For the present, cautioned Neville, outdoor 15-kv terminations are not recommended, nor is use of the epoxy-Orlon system for splices and terminations on polyethylene cables. However, both utilities have this facet of the problem under investigation also.

Results of in-place pole inspection and treating, said F. P. Tierney, Northern States Power Co, show that after three years there was significant penetration of penta into sapwood but no significant penetration into heartwood. There was no significant penetration of water-soluble sodium fluoride into either heart sapwood or heartwood. Materials tested were 10% penta in petroleum grease; 10% penta in petroleum emulsion; a 10% penta, 16% creosote, 12% sodium fluoride solution; and a water-soluble solution with sodium fluoride the major constituent.

Before the industry is ready to accept hermetic sealing of watt-hour meters, operating practices and procedures will have to undergo many changes, some of these affecting regulations of public service commissions. And, said R. L. Dunning, Westinghouse, while hermetic sealing might be considered the next step in improvement of meters, there are inherent problems which have not been solved.

Some of these are of design and manufacture, while others are commercial decisions which would confront a present manufacturer of watt-hour meters. Nevertheless, Dunning stated, hermetic sealing is an industry objective, requiring research and development on the manufacturers' part and recognition of the need for changes in operating practices and regulations by the users and regulatory commissions.

With installation of a second generating unit, savings are indicated through use of a monitoring and results computer to replace normal recording instruments. Thus Kansas Gas & Electric Co chose to install a digital computer system with the first unit (160 Mw, 1,800-1,000/1,000) at Gordon Evans Station, said N. F. Pinkstaff. Operation will be on a three-men-per-shift basis, with one man in the control room. This will continue when the second unit goes in, Pinkstaff said.

As a results computer, the system will compute the unit net heat rate. As a monitoring computer for the first unit, it will utilize 221 inputs of 396 available (384 analog, 12 digital). Outputs from the computer are in six different forms. For the present, Pinkstaff reported, 108 readings and calculations will be logged.

Engineering studies indicate that the exhaust-fired combined cycle can be applied to a high capacity, high-economy single generating unit at costs comparable with reheat units of similar size. Such a combined gas turbine-steam turbine cycle, said J. Bruce Stout, OG&E, is expected to provide normal operating flexibility in load range between 25% and full-load capability with fuel economies better than a conventional and similar reheat cycles. And the combined cycle should perform as readily to centralized controls as a conventional unit, Stout said.

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Instrument Society of America—Air Pollution Instrumentation Symposium (with the June 11-15 Annual Meeting of the Air Pollution Control Association), Hotel Commodore, New York City, June 12.

Pennsylvania Electric Association—Personnel Practices, Hershey, Pa., June 22-23; General & Customer Accounting Committee, Bedford Springs Hotel, Bedford, Pa., June 22-23; Customer Contact Committee, Erie, Pa., June 23; Industrial Committee, Penn State, Pa., June 23; Taxation Committee, Pittsburgh, June 26-27; Plant Accounting & Records Committee,, Allenbury, Pa., June 29-30.

Wisconsin Utilities Association—Accounting Conference, Dell View Hotel, Lake Delton, Wisconsin, June 11-13.

Wisconsin Municipal Utilities Association—Annual Conference, Imhoff's Lake Delton, June 11-13.

American Society of Mechanical Engineers—Semi-Annual Meeting, Statler Hilton Hotel, Los Angeles, June 11-14.

Institute of Radio Engineers—Third National Symposium on Radio Frequency Interference, Sheraton Park Hotel, Washington, D. C., June 12-13.

Electric Council of New England—Commercial-Industrial-Area Development Workshop, Equinox House, Manchester, Vermont, June 12-14.

• **30th Annual Electrical Meter School**—Morehead City Technical Institute, Morehead City, N. C., June 13-16.

Northwest Public Power Association—Engineering and Operations Section, Annual Workshop, Marion Hotel, Salem, Oregon, June 15-16.

American Institute of Electrical Engineers—Summer General Meeting, Ithaca, June 18-23.

Mountain-Pacific Conference of Public Utilities Commissioners—Princess Kaiulani Hotel, Honolulu, Hawaii, June 18-24.

Michigan Gas & Electric Association—Mackinac Island, June 19-21.

American Standards Association—Industrial Standardization Seminar, Engineering Societies Building, New York City, June 19-23.

American Society For Testing Materials—Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 25-30.

Canadian Electrical Association—71st Annual Meeting, Banff Springs Hotel, Banff, Alta., June 26-28.

JULY

National Society of Professional Engineers—27th Annual Meeting, Olympic Hotel, Seattle, Washington, July 4-7.

AUGUST

• **Western Electronic Show & Convention**—Cow Palace, San Francisco, Aug. 22-25.

• **American Institute of Electrical Engineers**—Pacific General Meeting, Hotel Utah, Salt Lake City, Aug. 23-25.

• **American Society of Mechanical Engineers**—International Heat Transfer Conference, University of Colorado, Boulder, Aug. 28-Sept. 1.

• **American Institute of Mining, Metallurgical, & Petroleum Engineers**—Third Annual Semiconductor Conference, Ambassador Hotel, Los Angeles, California, Aug. 30-Sept. 1.

Electrical World's Fifth Electric Heating Conference — Sheraton-Park Hotel, Washington, D. C., Sept. 25-26.

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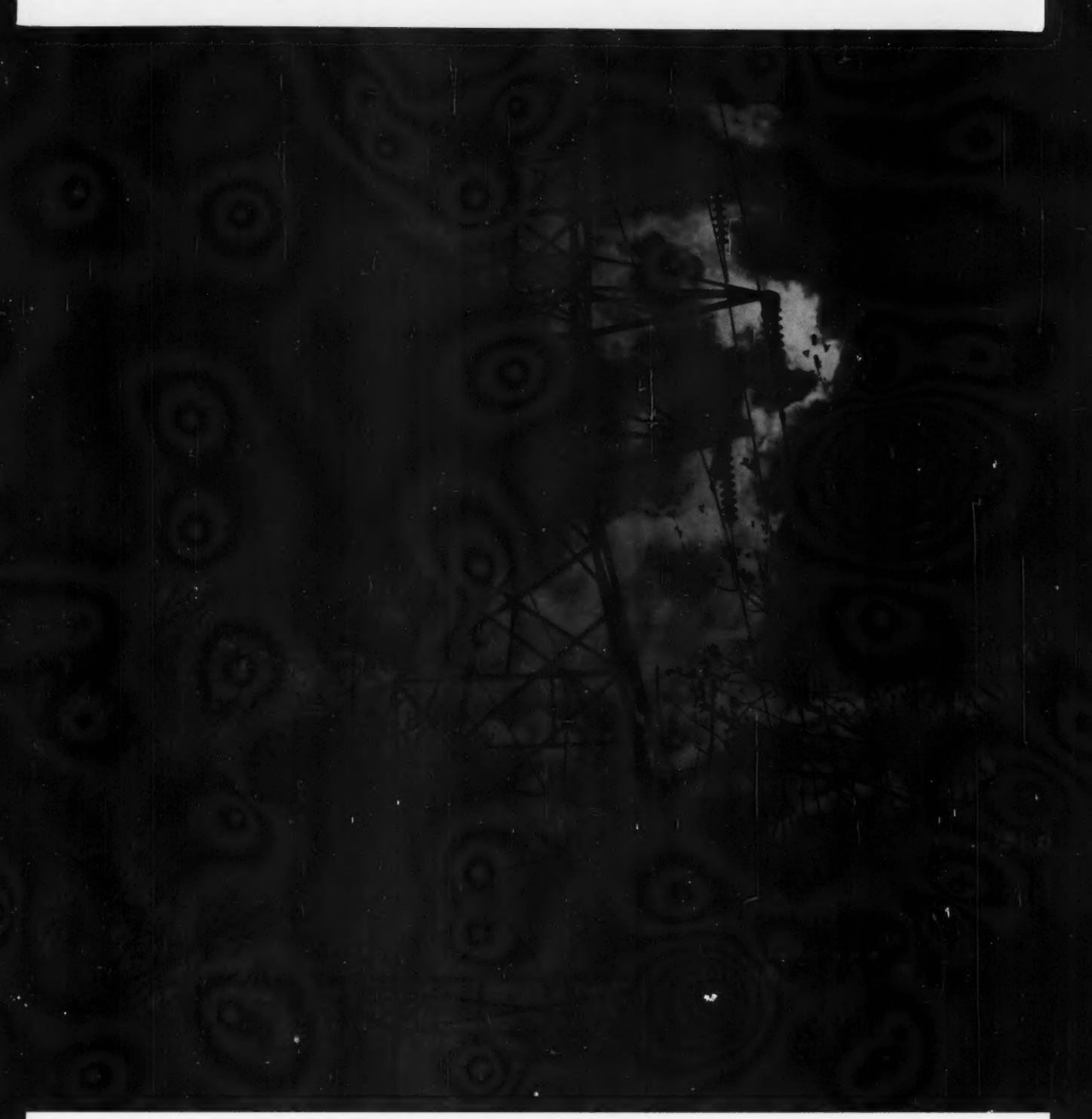

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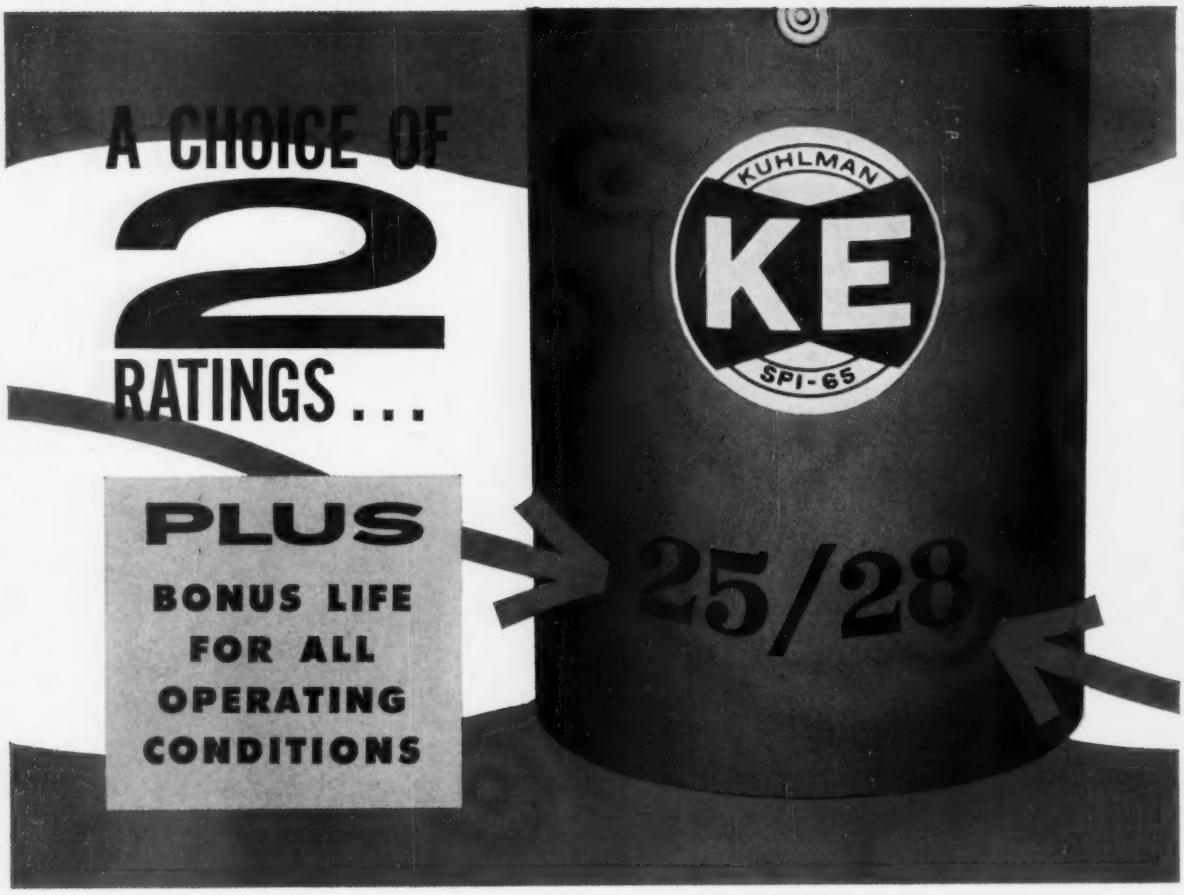

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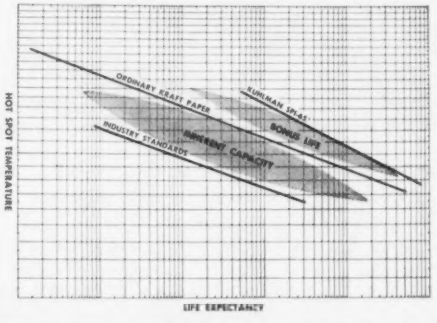

This life versus temperature test chart shows the inherent capacity and bonus life of Kuhlman transformers.

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